

No. 1815

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**HANDBOOK OF THE**  
**75-MM. GUN MATÉRIEL**  
**MODEL OF 1917 (BRITISH)**

**WITH INSTRUCTIONS FOR ITS CARE**

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*(THIRTY PLATES)*

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**FEBRUARY 9, 1918**



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**1918**

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WAR DEPARTMENT,  
OFFICE OF THE CHIEF OF ORDNANCE,  
*Washington, February 9, 1918.*

This manual is published for the information and government of  
the Army of the United States.

By order of the Secretary of War:

C. B. WHEELER,  
*Brigadier General, N. A., Acting Chief of Ordnance.*

(3)



## ERRATA.

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### AMMUNITION FOR 75-MM. GUN, MODEL 1917 (BRITISH).

Page 17: Temperature of gas should be  $-15^{\circ}$  F.

Page 17: A paper cup has been substituted for stopper of fibrous guncotton.

Page 18: 75 mm. projectiles are not marked with a prick punch, but stenciled.

Page 22: The Mark III fuze, through error, is not illustrated.

Page 23 (illustration): The Mark IV fuze is described under Mark V fuze, but has no head arming feature.

Page 23: Correct index of Mark V fuze, Plate VII:

A, Closing cap.	I, Detonator casing.
A <sup>1</sup> , Compressed black powder.	M, Detonator.
B, Head arming casing.	N, Cloth disk.
B <sup>1</sup> , Arming casing.	Q, Duplicates I.
C, Head plunger.	R, Powder.
C <sup>1</sup> , Washer.	S, Felt washer.
D, Fuze body.	T, Felt washer.
D <sup>1</sup> , Arming spring.	U, Retard spring.
E, Head arming casing prongs.	U <sup>1</sup> , Safety casing.
F, Head arming spring.	V, Percussion plunger plug.
F <sup>1</sup> , Head safety support.	W, Percussion plunger.
G, Detonator socket.	X, Powder pellet.
H, Delay retard carrier.	Y, Percussion primer.
I, Relay cup.	Z, Firing pin.
J, Felt washer.	Z <sup>1</sup> , Firing pin plug.
K, Felt washer.	

### PAINTS ON PROJECTILES.

Common steel shell is painted yellow when filled with high explosive, and is painted green when filled with gas.

Common shrapnel is painted red.

Shrapnel rounds are contained complete in a fiber container.

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# **LIST OF EQUIPMENT PERTAINING TO ONE 75-MM. GUN BATTERY ON WAR FOOTING.**

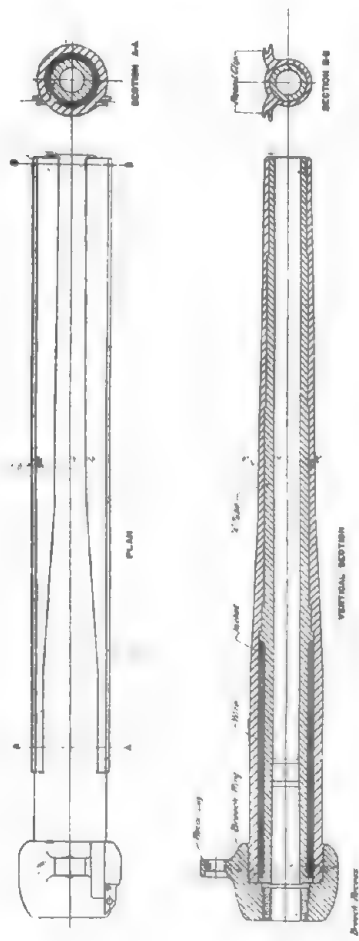
Number.	Equipment.
4	75-mm. guns, model of 1917 (British).
4	75-mm. gun carriages, model of 1917 (British).
4	75-mm. gun-carriage limbers, model of 1917 (British).
12	75-mm. gun-caisson limbers, model of 1918.
12	75-mm. gun caissons, model of 1918.
1	Forge limber, model of 1902-M1.
2	Battery and store wagon, model of 1917.
	1—as battery wagon.
	1—as store wagon.
1	Store limber, model of 1902-M1.
1	Battery reel, model of 1917.
1	Set of fire-control instruments and equipment.
19	Sets of breast-collar harness (wheel).
37	Sets of breast-collar harness (lead).
1	Set of breast-collar harness for battery reel.

# **75-MM. FIELD GUN, MODEL 1917 (BRITISH)—WEIGHTS, DIMENSIONS, ETC.**

(PLATES I AND II.)

Weight.....	pounds..	995
Caliber.....	inches..	2.95
Total length.....	do....	88.21
Length of bore.....	do....	83.915
Length of rifled portion of bore.....	do....	<u>72.72</u>
Rifling:		
Number of grooves.....		24
Width of grooves.....	inch..	.2874
Depth of grooves.....	do....	.02
Width of lands.....	do....	.0992
Twist, right-hand, zero turns at origin to 1 turn in 75 inches (25.4 cals.) at 9.72 inches from muzzle, thence uniform.		

NOTE



75mm Field Gun Model of 1917 (British)

# DESCRIPTION OF THE 75-MM. FIELD GUN, MODEL OF 1917 (BRITISH).

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## (PLATE I.)

The gun is built up of alloy steel, consisting of a tube, a series of layers of steel wire, jacket, and breech ring. The tube extends from the rear end of the chamber to the muzzle. Over the rear portion of the tube are wound 15 layers of 0.04 by 0.25 inch steel wire. The jacket is fitted over the exterior of the wire and the tube, and is secured longitudinally by corresponding shoulders and the breech ring, which is screwed over the jacket at the rear, and secured by a set screw. The breech ring is prepared for the reception of the breech mechanism, and is provided on the upper side with a lug for the attachment of the hydraulic buffer. Longitudinal projections on each side of the jacket form guides for the gun when in the cradle of the carriage.

A plane for clinometer is prepared on the upper surface of the breech ring.

Vertical and horizontal axis lines are cut on the muzzle and horizontal faces.

## DESCRIPTION OF THE BREECH MECHANISM.

### (PLATE II.)

The breech block is of the interrupted screw type tapering toward the rear. It has two threaded and two flatted sectors, in rear of which is a cylindrical section, larger in diameter, on which is a thread for securing the block to the carrier. The breech recess of the gun is threaded and slotted to correspond with the threads on the block. The latter is bored out axially to form a seat for the firing pin. The front of this axial hole is closed by the breech block bushing, which is screwed into position and held by a fixing screw through the breech block. The rear end is closed by the striker guide block, which is held in place by means of the hand

lever hinge bolt passing through it. A hole through the breech block and channels formed in the carrier affords a vent for any gases escaping from a ruptured primer or cartridge case. For repairing worn breech block bushings, first remove the fixing screw and unscrew the bushing from the interior of the breech block by the special wrench provided.

The block carrier is hinged on the right side of the breech recess by the carrier hinge bolt; it is bored out and threaded to receive the block as mentioned before. The outer face of the carrier is recessed for the striker guide block and two lugs are provided for the hinge bolt of the breech mechanism hand lever.

A stop for limiting the rotation of the breech block when in its open position is fitted on the front face of the block carrier.

Hinged to the rear face of the carrier is the hand lever, provided with bevel teeth which engage with corresponding teeth on the rear face of the breech block, so arranged that when the lever is pulled to the right, the first movement of the lever unlocks the breech block, and on continuing the motion, the block and carrier are swung into the loading position.

The hand lever is retained in the closed position by means of a catch with flat spring, pivoted in the lever, one end of which engages a recess in the lower lug on the rear face of the carrier.

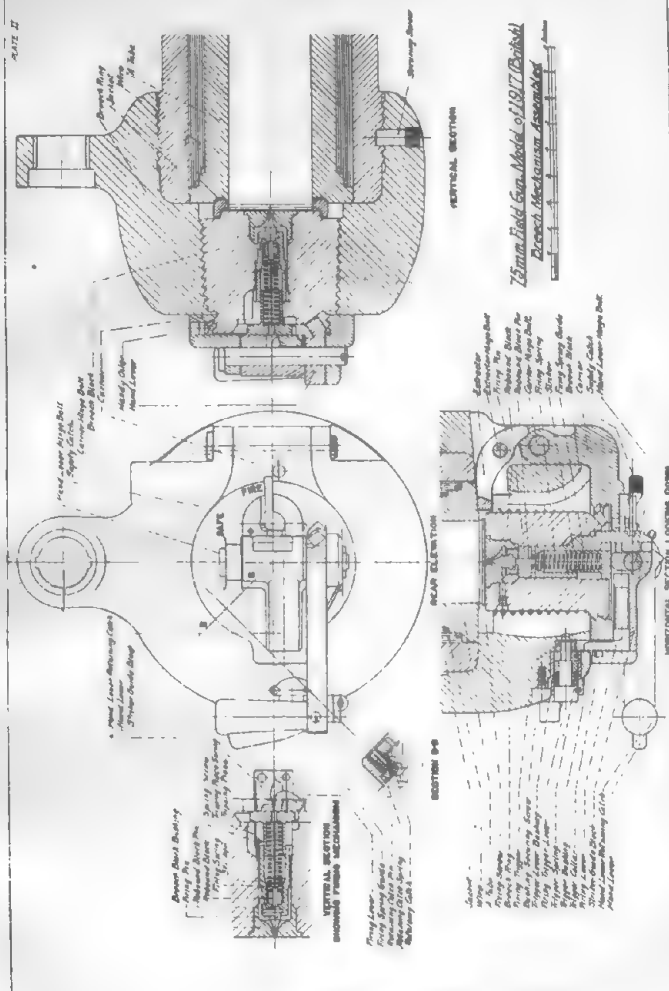
#### THE FIRING MECHANISM.

The firing mechanism belongs to that type known as a continuous-pull mechanism and is so arranged that the gun can not be fired before the breech block is home and the hand lever locked.

The mechanism consists of a striker with firing pin, rebound block and securing pin, firing spring, guide for spring, and tripping piece with flat spring and spring screw, fitted through the center of the breech block and retained in position by the striker guide block on the carrier.

A steel firing lever in the interior of the striker guide block, serves to cock the striker and fire the gun, one end of the lever engaging with the tripping piece and guide for spring, and the other end with the trigger in the left side of the gun when the breech is closed.

The extractor is of steel, and is hinged to the right side of the gun. On the inner end are two arms which clip the rim of the cartridge, the outer end forming a lug, by means of which the extractor is automatically actuated in opening the breech.



## ACTION OF THE BREECH MECHANISM.

To open the breech, grasp the hand lever; at the same time compress the hand lever retaining catch. This releases the catch from the recess on the carrier. Rotate the hand lever to the rear. During the first part of this movement ( $120^{\circ}$ ) the block is rotated and its threads disengaged from those of the gun, at which time the retaining catch in the carrier will drop into its notch in the block at the moment of swinging the carrier from the gun. The block is now locked against further rotation in either direction. During a further rotation of the hand lever of about  $110^{\circ}$  the block and carrier swing about the carrier hinge bolt clear of the breech recess, the pallet on the carrier forces the extractor lever inward, unseating the cartridge case before the end of the  $110^{\circ}$  movement, and finally ejects the case free of the gun. When another round is inserted the rim of the cartridge case comes in contact with the extractor and forces it partly home. In closing the mechanism the movements are simply the reverse of opening; as the block carrier comes in contact with the breech face of the gun, the retaining catch is forced rearward, unlocking the block from the carrier. Further rotation of the operating lever rotates the breech block, causing its threads to engage those of the gun. This engagement of threads moves the block forward, due to the pitch of the threads, and firmly seats the cartridge in the gun. At the final motion of the hand lever its catch engages in the recess in the left face of the lower hand lever hinge bolt lug, locking the block in the closed position. The gun is now ready to fire.

## ACTION OF THE FIRING MECHANISM.

The trigger is actuated by a direct pull on the firing gear of the carriage, thus partially revolving the firing lever, by means of which the striker is forced to the rear, and the guide for spring to the front; the mainspring is thus compressed until the projecting toe on the inner end of the firing lever slips past the front end of tripping piece, in striker guide block, when the striker is free to go forward with momentum due to the energy stored up in the compressed mainspring, and detonates the percussion primer of the cartridge.

## TO DISMANTLE THE BREECH MECHANISM.

Grasp the hand lever and open the mechanism: remove the cotter pin from the hand lever hinge bolt, and withdraw the hinge bolt, when the hand lever, guide block with firing lever and striker can be

removed. When removing the striker from or inserting it into, the guide block, the safety catch in the latter must always be in the firing position. Slide the firing pin out of the groove in the front end of the striker. Press the top of the spring guide so as to slightly compress the mainspring, and at the same time tilt the upper end of the guide from the striker, and withdraw the guide and mainspring. Place the safety catch in the firing position, and force it out of its recess in the guide block toward the center of the block and withdraw it. Press the retaining catch into its seat in the carrier and unscrew the block (to the right) from the carrier. Withdraw the retaining catch and spring. Now remove the cotter pin of the carrier hinge bolt, and the bolt and carrier are free to be withdrawn. Next remove the cotter pin of the extractor hinge bolt and withdraw this piece and the extractor. Remove the trigger split pin and withdraw the firing trigger lever with bushing, collar and spring from the left side of the gun. The firing lever is then easily removed from the rear.

Reverse these operations for assembling the mechanism.

### CARE OF THE GUN.

After firing, the bore of the gun should be cleaned to remove the residue of smokeless powder, and then oiled. In cleaning wash the bore with a solution made by dissolving one-half pound sal soda in one gallon of boiling water. After washing with the soda solution wipe perfectly dry, and then oil the bore with a thin coating of light slushing oil furnished for the purpose.

The breech mechanism should be kept clean and well oiled. It should be dismounted from time to time for examination and oiled when assembled. The spare parts carried in the battery wagon should be well coated with vaseline or heavy oil and each piece then wrapped in paper to prevent the oil from being rubbed off.

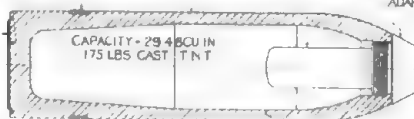
A tool for the removal of burrs from the striker recess in the breech screw is provided. This tool is of steel and consists of a cutter with holder, sleeve and guide block.

### AMMUNITION.

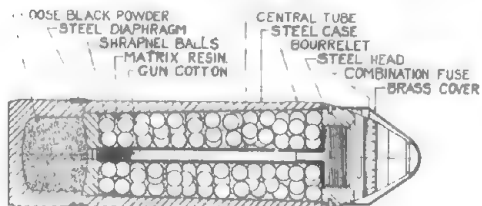
Fixed ammunition is used in the 75-mm. field gun, and is made up with either common shrapnel or common steel shell. A complete round of shrapnel is 23.37 inches in length fuze: of shell 22.56 inches unfuzed. Battery ammunition chests are of sufficient size to take either of the rounds furnished, and the number of each kind to



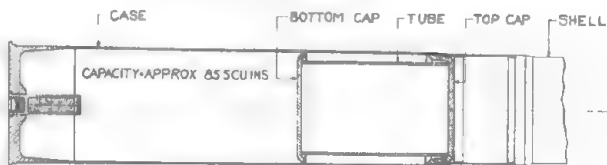
BASE COVER  
LEAD DISC ROTATING BAND STEEL SHELL BOOSTER  
ADAPTER



75 MM COMMON STEEL SHELL



75 MM SHRAPNEL



75 MM FIELD GUN CARTRIDGE CASE

BASE OF CASE



36-23-118

be carried is subject to regulation by proper authority. Each round of shrapnel is issued with the projectile filled and fuze. Each round of shell is issued filled but not fuze, but contains an adapter with booster charge. The projectiles average in weight: Shrapnel, 16 pounds, fuze; shell, 12.4 pounds, fuze. The components of one round are: The cartridge case with primer, the powder charge, projectile, and fuze.

#### THE CARTRIDGE CASE.

The cartridge case is solid drawn brass and is 13.82 inches long. Its capacity is 85.5 cubic inches. With primer, the case weighs 2.67 pounds. A projecting flange or rim is formed on the head of the case which is engaged by the lip of the extractor. The seat into which the primer is forced is bored out of the center of the head. To avoid injury to this primer seat, the primers are inserted by the small primer inserting press furnished. For removing exploded primers from cartridge cases special decapping tools are also issued.

For the identification of steel shell only, a black stripe 0.375 inch is painted diametrically across the base of the cartridge case, and the name of the gun, initials of place, year of manufacture and ammunition lot number are stamped into the brass to a depth of 0.02 inch.

#### THE PRIMER.

(PLATE III.)

In addition to the essential elements of a percussion primer, the primer for the 75-mm. cartridge case contains an igniting charge of 49 grains of black powder. This "49-grain percussion primer" is shown in Plate III and consists of a brass case resembling in shape a small-arms cartridge case. The head or rear end of the primer case is countersunk, forming a cup-shaped recess, in which is seated the cap or percussion primer proper. The latter consists of the cup, the anvil, and the percussion composition, assembled as shown in the plate.

The percussion-cap recess is connected with the interior of the primer case by a small vent. The body of the case contains 49 grains of black powder, which constitutes the igniting charge for the smokeless powder. After being filled, the front end of the case is closed by a paper wad covered with shellac. The end of the primer tube is crimped over the wad to secure it. When the blow of the firing pin explodes the percussion cap, the black powder is ignited and the flame shot directly forward into the smokeless powder charge, exploding it.

### THE POWDER CHARGE.

Multiperforated nitrocellulose powder having seven perforations to each cylindrical grain constitutes the charge which averages 24 ounces to the round. A cardboard obturator consisting of a cardboard tube 4 inches long, with covers at each end, is inserted between the base of the projectile and the charge. The charge is thus held to the rear of the cartridge case in contact with the primer. A muzzle velocity of 1,750 feet per second for shrapnel is the standard.

Range tables for 75-mm. shell and shrapnel are published under separate cover.

Owing to the difference in the shape and weight of the projectiles, no adjustment of charge had been made to permit the use of a single range table. The shell range table must be used when changing fire from shrapnel to shell.

### PROJECTILES.

Common steel shell accommodating three types of point detonating fuses, also a gas-filled, common steel shell to be fired with an instantaneous action point fuse, and common shrapnel are the projectiles for use with the 75-mm. gun.

#### COMMON STEEL SHELL, MARK I.

This shell is shown in Plate III. It has an ogival head struck with a radius of 4.379 calibers and is fitted with a copper rotating band forced into an annular groove 1.65 inches from the base. The projectile is slightly beveled 0.2 inch below the rotating band to receive the crimping on of the cartridge case. In assembling the round the shell is forced into the case up to the band and the lip of the case crimped into the bevel, securely fixing it. Point fuses only are used with this shell which is tapped through the nose to receive the adapter for French type fuses. The base cover consists of a lead disk covered by a brass base cover which is crimped into an undercut groove and calked with lead wire. This cover prevents danger of premature ignition of the bursting charge through penetration of flame while in the gun. The bursting charge consists of 1½ pounds of cast T. N. T. or amatol. The weight of the shell, including bursting charge and adapter, is approximately 12 pounds. The three fuses used vary in weight from 0.6 pound to 1.2 pounds. The shell is never issued fused. It should not be carried fused in caissons or limbers, owing to the sensitiveness of the fuses.

**COMMON STEEL SHELL, GAS FILLED.**

The shell body of the 75-mm. gas shell is identical with the common steel shell, except that it has no base cover and that the tap hole to receive the adapter is tapered to make a gas-tight joint. The gas charge consists of phosgene or other gas which is liquefied by cooling below 15° F., and poured in. A sufficient space is left to allow for expansion when the gas regains atmospheric temperature. The screwing in of the adapter seals the gas hermetically in the shell body. A booster charge similar to the one used to explode the common steel shell is located in the adapter and is sufficient to open the nose of the shell and release the gas. Any of the fuses used with the common steel shell will fit the gas shell.

**COMMON SHRAPNEL, MARK I.**

(PLATE III.)

This is a base charged shrapnel fitted with a combination fuse. The case is of steel with solid base. The rotating band of copper is forced into an annular groove 1.65 inches from the base. The front or mouth of the case is closed by a steel head, screwed in and tapped to take the service combination time and percussion fuse. Assembling the projectile to the cartridge case is performed exactly as with the steel shell. The bursting charge consists of 3 ounces of loose, black shrapnel powder covered by a steel diaphragm. This diaphragm supports a steel central tube extending forward to the fuse, which acts as a conduit from the fuse to the bursting charge. At the lower end of the tube a stopper of dry fibrous guncotton about 1 inch long is fitted to prevent the loose shrapnel powder from entering the tube, and also to act as an accelerator to the bursting charge.

The shrapnel filling is composed of 270 lead balls about 0.5 inch in diameter, averaging 167 grains in weight. These balls are poured in around the central tube and rest upon the steel diaphragm. The space between the balls is filled with a resinous smoke producing matrix, which disintegrates and frees the balls during the burst of the shrapnel. The matrix also produces most of the smoke which makes possible the observation of shrapnel fire.

In action, the bursting charge does not rupture the shrapnel case, but strips out the head and ejects the diaphragm, throwing the balls forward with an increased velocity of about 347 feet per second.

## WEIGHT MARKINGS ON PROJECTILES.

In order that allowance may be made for variations in weight of loaded projectile in computing firing data, 75-mm. projectiles are classified by weight, and punch marked for quick identification. 75-mm. ammunition is marked to conform to the French system of marking and is the only United States ammunition which is not marked with an ordinary prick punch. The weight and markings are as follows:

10 pounds 11 ounces to 11 pounds.....	L
11 pounds to 11 pounds 5 ounces.....	+
11 pounds 5 ounces to 11 pounds 11 ounces..	++
11 pounds 11 ounces to 11 pounds 15 ounces..	+++
11 pounds 15 ounces to 12 pounds 5 ounces..	++++

These marks are placed about one-half inch in rear of the bourrelet and spaced one-half inch apart. They are deep enough to be felt and be counted by sense of touch, enabling artillerymen to recognize weights of projectiles during night firing. For shell the weights indicated by the marks indicate the weight of loaded projectile and booster, but without fuze. For shrapnel the weight of the fuze will be included, as it is the only round shipped fuzed.

## FUZES.

FRANKFORD ARSENAL 21-SECOND COMBINATION FUZE, MODEL OF 1907-M.

(PLATE IV.)

The fuze consists of the following parts, assembled as shown in the drawing:

- a, body, bronze.
- a', stop pin, brass.
- b, closing cap, brass.
- b', vents in closing cap.
- c, upper time-train ring, Tobin bronze.
- c', washer for time-train ring, graduated felt cloth.
- d, time-train ring, graduated Tobin bronze.
- d', washer for body, felt cloth.
- e, rotating pin, brass.
- e', concussion plunger.
- e', concussion resistance ring, brass.
- f, firing pin, brass.
- g, vent leading to upper time train.
- h, compressed powder pellet.
- i, upper time train, compressed powder.
- j, compressed powder pellet in vent leading to lower time train.
- j', compressed powder pellet in lower time-train vent.

21 SECOND COMBINATION FUZE MODEL OF 1907 M.

FIG. 1

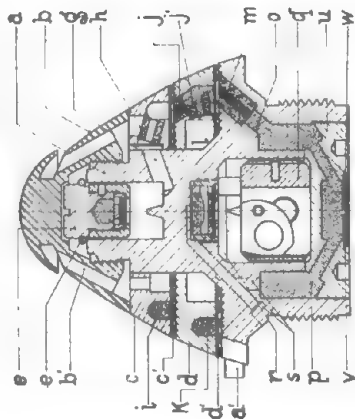
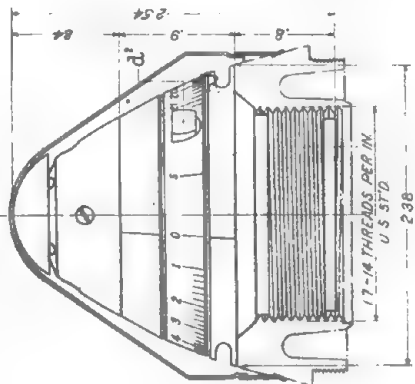


FIG. 2



2 INCHES



36 23 67

- k*, lower time train, compressed powder.
- l*, brass disk, crimped in place.
- m*, compressed powder pellet in vent *o*.
- o*, vent leading to magazine.
- p*, powder magazine.
- q*, percussion plunger.
- r*, percussion primer.
- s*, vents leading from percussion primer to magazine.
- u*, bottom closing screw, brass.
- v*, washer for closing screw, muslin.
- w*, washer for closing screw, brass.

The body *a* of this fuze is machined from a bronze casting. The time-train rings *c* and *d* are turned from hard-rolled rods of Tobin bronze. An annular groove in the shape of a horseshoe is milled in the lower face of each of the time-train rings. Meal powder is compressed into these grooves under a pressure of 66,000 pounds per square inch, forming a time train, the total length of which is 9 inches.

The time element of this fuze is composed principally of the following parts: The time or concussion plunger *e*, the concussion resistance ring *e'*, the firing pin *f*, the vent *g*, leading to the upper time train *i*, the vent *j*, the lower time train *k*, the compressed powder pellet *m*, in the vent *o*, leading to the magazine *p*.

The plunger *e* is cylindrical in shape and contains percussion composition in a recess at its base. The weight of the plunger rests upon the concussion resistance ring *e'*, which keeps the primer from contact with the firing pin. At discharge of the gun the resistance of the ring is overcome and the primer is exploded by contact with the firing pin.

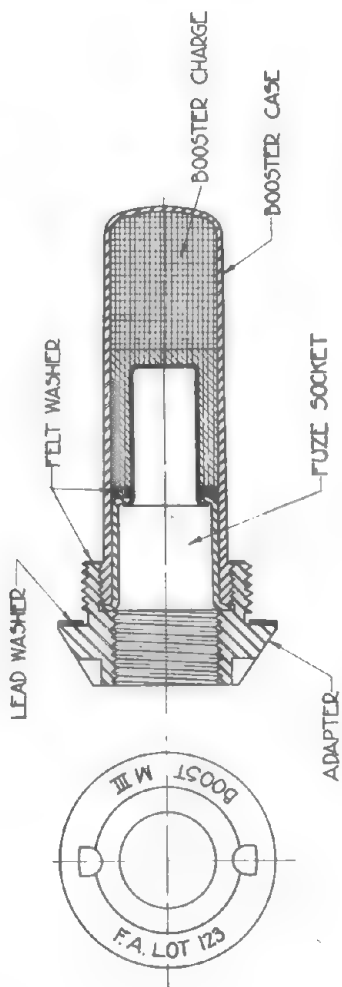
The upper time-train ring *c* is prevented from rotating by pins which are halved into the fuze body and the inner circumference of the ring. The vent *g* is drilled through the walls of the concussion plunger chamber and is exactly opposite a hole in the inner surface of the upper time train leading to the end of the train from which the direction of burning is counterclockwise.

The hole *j* is drilled through the upper face of the lower time train ring *d* to the end of the lower time-train groove, from which the direction of burning is clockwise. The lower time-train ring is movable and is graduated on its outer edge in a clockwise direction from 0 to 21.2, each full division corresponding to approximately 1 second time of burning in flight; these divisions are subdivided into five equal parts corresponding to one-fifth second. A radial pin *d2* is provided in the lower ring for engagement with a notch in the fuze setter for setting the fuze. A line on the lower flange of the fuze stock is the

datum line for fuze settings. The vent *o* is drilled through the flange of the fuze stock to the powder magazine *p*, and leads to the same end of the lower time train as the vent *j*, the end from which the direction of burning is clockwise, when the fuze is at "zero" setting. The action of the fuze as a time fuze is as follows: Assume first the "zero" setting as shown on the figure. At discharge of the gun the time plunger arms and fires its primer. The flame from the primer passes out through the vent *g*, igniting the pellet *h*, the end of the upper time train *i*, down through the vent *j*, to the end of the lower time train *k*, and thence through the vent *o* to the magazine *p*, the flame of which is transmitted to the base charge in the shrapnel. It will be seen that for the "zero" setting of the fuze the origin of both upper and lower time trains are in juxtaposition. Assume any other setting, say 12 seconds: The vent *j* has now changed its position with respect to the vent *o*, leading to the powder magazine *p*, both of which points are fixed by the angle subtended between the 0 and the 12-second settings. The flame now passes out through vent *g*, and burns along the upper time train in a counterclockwise direction until the vent *j* is reached, where it passes down to the beginning of the lower time train and burns back in a clockwise direction to the position of the vent *o*, whence it is transmitted by the pellet of compressed powder *m* to the powder magazine *p*.

For the 21.2-second settings the vent *j*, leading to the beginning of the lower time train, is opposite the end of the upper time train, and the end of the lower time train is opposite the vent *o*, leading to the powder magazine. It will now be seen that to reach the magazine *p* and burst the shrapnel, the entire length of the time train in both rings must be burned. As already stated, the annular grooves in the lower face of each ring for the powder trains do not form complete circles, a solid portion being left between the ends of the grooves in each. This solid portion is utilized to obtain a setting at which the fuze can not be exploded, known as the "safety point." This point is marked by a line on the outer edge of the movable time train, surmounted by an "S" and is located about half-way between the "zero" mark and the 21.2-second graduation. When this point is brought opposite the line on the lower flange of the fuze body, the vent *j* is covered by the solid metal between the ends of the upper train, and the vent *o* leading to the powder magazine *p* is covered by the solid metal between the ends of the lower, or movable, time train. At the safety setting it will be seen that the upper time train may burn entirely out in case of accidental firing of the time plunger, or in case it may be desired to burst the shrapnel





36-23-46.

ADAPTER AND BOOSTER CASING - MARK III.

by impact or percussion without the flame being able to reach the magazine *p*.

The cloth washers *c'* and *d'* are glued to the upper face of the graduated time-train ring and to the upper face of the flange on the fuze stock. The surfaces are corrugated, as shown, to make the washers adhere more strongly. The function of the washers is to make a gas check and prevent premature action of the fuze. The compressed pellet *j'* in the vent leading from the outside to the beginning of the lower time train is to release the pressure of the gases due to the burning train. The gases from both time trains escape into the outer air through the annular spaces shown in the illustration, and the vents *b'* in the closing cap.

The percussion element of this fuze, as shown in the plate, consists of a percussion plunger *q*, and the ordinary percussion primer *r*. The system of vents through the walls of the fuze shown in figure 2 conduct the flame from the percussion primer to the magazine *p*. The bottom closing screw closes the percussion plunger recess and keeps the powder in the magazine. The muslin washer *v* is coated with shellac and held in place by the brass washer *w*, over the outer edge of which a projecting lip is crimped. These fuzes are issued assembled in shrapnel. For transportation in limbers and caissons the fuze should always be set at the "safety point." The fuze is provided with a waterproof hood of thin metal, hermetically sealed. The hood should be stripped off before an attempt is made to set the fuze.

#### ADAPTER AND BOOSTER CASING, MARK III, FOR FRENCH 24/31 FUZES.

To adapt the French type fuzes Mark III and Mark V to the 75-mm. shell, an adapter embodying a high-explosive booster is used, which is shown in Plate V. The adapter consists of a flanged steel collar, threaded on the outside with a standard thread to screw into the head of the shell up to the flange. The inner circumference below the flange is also threaded to receive the steel tube constituting the booster casing. Through the flanged section, the collar is threaded to receive the French threading on the fuze stocks. A tubular fuze socket holder of steel is fitted to the inside of the booster casing. It has an inner lip which supports the outer lip of copper or brass fuze socket, which is passed through it and soldered fast. In assembling, the lower end of the booster casing is filled with 214 grains of T. N. T. under pressure of 5,000 pounds per square inch, followed by 214 grains of tetryl, which is packed up and around the fuze socket under pressure of 5,000 pounds to the square inch and

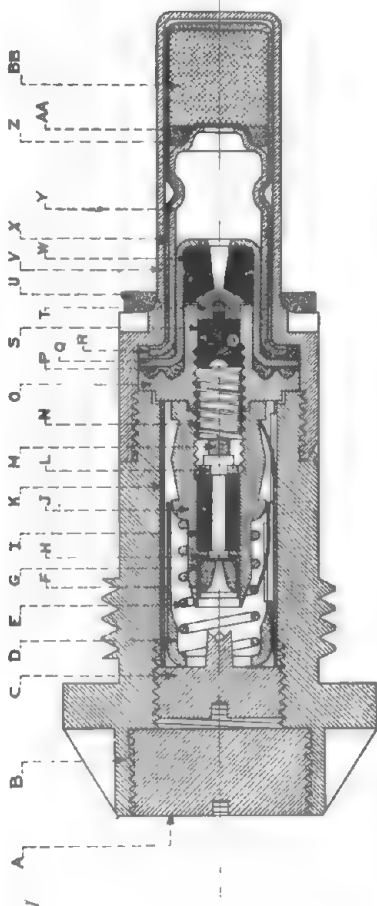
held in place by a felt washer. This washer encircles the fuze socket at its juncture with the fuze socket holder. Screwing the booster casing into the adapter plug brings the upper lip of the fuze holder tightly against the upper rim of the booster casing, holding the entire contents of the casing fast. The adapter and booster are now ready to be screwed into the shell. As the fuzes are never assembled to the shell until the round is about to be used, an adapter plug is supplied which acts as a protection against the entrance of foreign substance or moisture into the socket. It consists of a compressed felt washer held between an upper washer of tin and a lower washer of copper, both held together by a twisted wire link. The link is first passed over the circumference of a ring which acts as a lifting handle and means of unscrewing the plug.

#### ADAPTER AND BOOSTER CASING, MARK IV, FOR 75-MM-GAS SHELL.

Owing to the necessity for a gas-tight joint in this shell, the booster casing is made of a single tube of steel and the adapter is tapered where threaded into the shell. The booster charge and method of assembly are identical with those of the common steel shell except that the fuze socket holder is held by a bushing threaded into the adapter collar. This bushing is threaded on the inside to take the thread on the French fuzes.

#### POINT DETONATING FUZE, I. A. L., MARK III.

This fuze is designed to burst the shell before it can enter the ground. "I. A. L." signifies *Instante Allongé Lefèvre*, or the instantaneous, elongated fuze of the Lefèvre design. Its principal parts are: The body *a*, the cap *b*, the firing pin *c*, firing pin head *c'*, supporting washer *d*, half rings *e*, spiral *f*, safety pin *g*, percussion primer *h*, upper detonator *i*, and lower detonator *j*. The action of the fuze is as follows: The rotation of the projectile causes the spiral to unwind, due to centrifugal force acting on the weighted end. When the spiral flies off, the half rings accompany it. This arms the fuze by permitting the backward thrust of the pin on impact to fall directly on the safety pin *g*. When the pin is bent, the firing pin *c* impinges on the percussion primer. The explosion of the primer in turn explodes the upper detonator. The flame from the upper detonator reaches the lower detonator *j*, through the channel *k*, exploding it and detonating the booster charge in the booster casing. These explosions follow in such rapid succession as to make the bursting of the shell practically simultaneous with the first impact of the firing pin head.



POINT DETONATING FUSE MARK IV.

## POINT DETONATING FUZE, MARK V.

This fuze is designed so that a slight change in its components in assembling, makes it either a delay-action or a nondelay-action fuze. A double arming feature distinguishes this fuze from other types. The principal parts are: Fuze body *d*, detonator *m*, closing cap *a*, firing pin *z*, head safety support *c*, head safety spring *f*, head plunger *c*, head plunger casing *b*, detonator *m*, relay cup *i*, percussion plunger *w*, percussion primer *v*, delay retard carrier *h*, safety casing *v'*, arming casing *b'*, arming spring *d'*.

In action, the head plunger *c*, through its inertia at the impulse of the propelling charge, compresses the spring *f* and engages the points of the casing *b* with the head safety support *f*, locking them. The head plunger and head safety support are now free from the pressure of the spring *f* and can either creep forward or move forward on impact so that the firing pin is exposed and the fuze armed. The arming casing *b'*, at the impulse of discharge parallels the action of the head plunger above described by pushing back the arming spring *d'*. The sides of the arming casing *b'*, disengage the prongs of the safety casing *u'*, freeing the percussion plunger *u* for movement forward, while the prongs of the arming casing engage the collar on the side of the percussion plunger *w*. The arming casing is thus held back exposing the percussion primer and completing the arming of the fuze. At impact, the percussion plunger *w*, goes forward and is exploded by the firing pin *z'*, the compressed black powder in the firing pin plug *a'* ignites, the flame being communicated to the uncompressed black powder in the percussion plunger *w*. This in turn ignites the delay charge in the delay retard carrier, which consists of Army black powder compressed to about 42,000 pounds to the square inch. The length of delay depends on the length of this compressed powder to be burned. The long delay is approximately 0.15 of a second; the short delay about 0.05 of a second. When the flame of the delay train reaches the quick match *q*, it ignites the slightly faster-burning powder in the relay cup *i*, which explodes the 30 grains of fulminate of mercury in the detonator. This detonates the booster charge in the adapter and explodes the shell.

For nondelay action the amount of compressed black powder in the percussion plunger is lengthened and the delay charge and quick match removed. This permits the flame to flash directly to the charge in the relay cup and to cause the explosion of the detonator as before.

This latter action, while not used in the Mark V fuze, is utilized to create a Mark IV fuze similar to the Mark V and with which the artilleryman should be familiar. This fuze is a nondelay Mark V without the head arming feature.

It arms at lower muzzle velocity than Mark V and is less safe for that reason. Owing to the superiority of the Mark III, I. A. L., fuze, the Mark IV is not a regular 75-mm. issue fuze; 75-mm. gun squads may, however, be called upon to use it.

### IDENTIFYING PAINT MARKS ON DELAY-ACTION FUZES.

Distinguishing colors indicate the delay action of the fuzes used in 75-mm. projectile as follows. Long-delay Mark V fuzes have the head-closing cap painted black, and the detonator socket painted violet. Short-delay Mark V fuzes have the black head cap only. Nondelay action in Mark IV fuzes is indicated by the fact that the head closing plug is white.

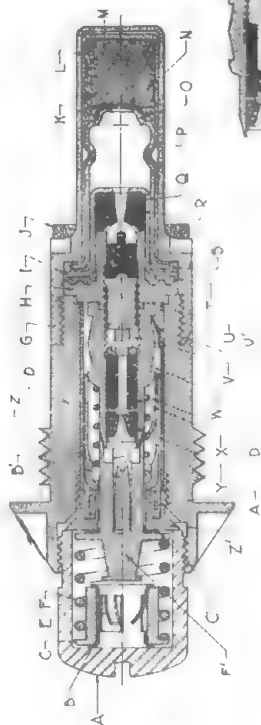
### MARKING ON AMMUNITION PACKING BOXES.

For quick and accurate identification, the 75-mm. ammunition packing box is marked on top, on both sides and on both ends, as shown in Plate VIII.

The symbol marking identifies the type of ammunition instantly: The smaller more explicit marking is a check and teaches the significance of the symbols, also giving quantities. Black only is the color used in marking these boxes. The marking follows a fixed system.

The type of cartridge or projectile shown to the right of the ordnance escutcheon (side view) is always representative of the kind contained, whether separate loading, fuzed, or unfuzed, etc. The size of the piece, whether in inches or millimeters always appears in the same place, as does also the letter indicating whether ammunition is for gun, howitzer, antiaircraft gun, etc. The lot number follows the word "Lot" and should always be referred to in reports concerning the failure of ammunition to function properly.

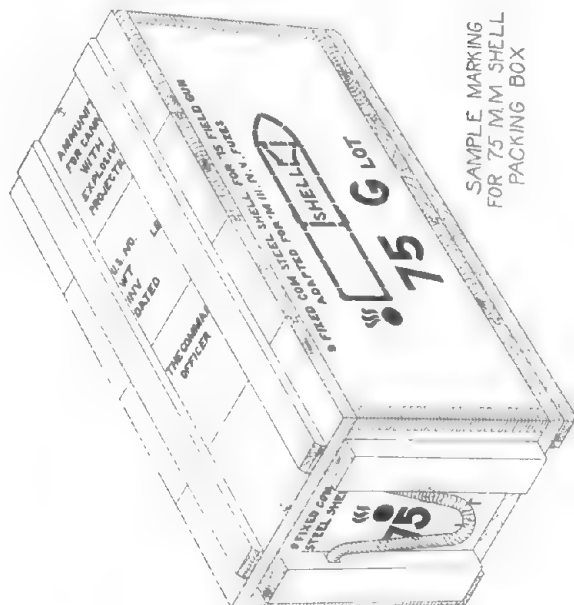
Practically the same marking appears on the ends with the exception of a representation of the round of ammunition. The place of packing and ordnance inspector's stamp are always placed on the upper left-hand corner of the top. Following downward, is a description of the type of ammunition contained. Following this is the U. S. number of the individual box and the total weight of the



FUZE - LONG AND SHORT DELAY



FUZE - NON-DELAY



SAMPLE MARKING  
FOR 75 MM SHELL  
PACKING BOX



box, together with the proper invoice number and the date of invoice.

Boxes in any invoice are numbered from No. 1 up to the total number of boxes the invoice contains. Finally, the destination for shipment is given.

### MARKING ON FUZE PACKING BOXES.

High-explosive shell requiring a booster can not safely be shipped fuzeless. Special packing boxes are provided for each type of fuze. They are marked on the top, sides, and both ends. The marking follows a fixed system, similar to that used on ammunition boxes. Ordnance inspector's stamp and place of packing appear on left top corner of case. The sentence, "Detonating Fuzes; Handle Carefully" appears next, to conform with interstate commerce requirements.

The U. S. number, weight, number of invoice and date, follow in order. Boxes in any invoice are numbered from 1 to the total number of boxes the invoice contains, for reference. The destination completes the marking of the top.

The side marking consists of one line giving quantity, whether base or point detonating, and the mark or number by which the fuze is known. Under this line is given length of delay, whether non, short, or long delay, and the lot number, to be used in reporting all cases of nonfunctioning fuzes.

Underneath is shown the ordnance escutcheon.

This marking is repeated on a smaller scale on both ends of the box.

### SUBCALIBER TUBE.

(PLATE IX.)

The subcaliber tube is used for subcaliber practice. It consists of a .30-caliber rifle barrel mounted axially in two bronze subcaliber adapters.

The breech end of the rifle barrel is screwed into the base adapter of the subcaliber tube while the muzzle end is threaded into the front adapter, which accurately fits the bore at the front end of the subcaliber tube and is capable of longitudinal motion to allow for expansion of the barrel. The steel ejector springs are each assembled to the rear adapter by an ejector spring screw.

During subcaliber practice the extractor of the gun will be removed in order to prevent the breechblock from defacing the base of the rear adapter. The subcaliber tube is inserted and pushed home in

the gun. The subcaliber cartridge, caliber .30, is then inserted in the chamber of the subcaliber barrel until its rim comes in contact with the ejector springs. The breech of the gun is closed, the face of the breechblock coming in contact with the subcaliber cartridge, caliber .30, shoves it into its seat compressing the ejector springs. When the breech is opened the ejector springs throw the case of the subcaliber cartridge, caliber .30, far enough to the rear to permit its removal by the fingers. The ammunition for United States magazine rifles of any model must not be used in subcaliber tubes; the primers not being adapted for the blow of the firing pins of cannon. A special caliber .30 cartridge has been adopted for this purpose and requisitions for subcaliber ammunition should call for "subcaliber cartridges, caliber .30."

As the residue of smokeless powder, if not completely removed, corrodes the bore in a short time, the subcaliber tubes should be cleaned carefully after use. The bore should be cleaned with a rag saturated with soda water (one-half pound sal soda to 1 gallon boiling water) and wiped thoroughly dry with a clean rag. Then oil the bore with a light coating of light slushing oil or other suitable oil.

#### DRILL CARTRIDGE.

(PLATE IX.)

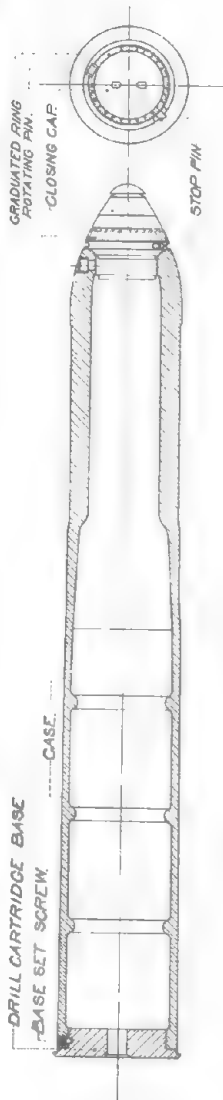
The drill cartridge is a dummy cartridge for use in drilling cannoneers in the service of the gun. It is a bronze casting of the shape of the service shrapnel ammunition and is fitted at the point with a Frankford Arsenal 21 second combination fuze. This arrangement is for the instruction of cannoneers in fuze setting.

#### SUBCALIBER AND DRILL CARTRIDGE KIT.

The subcaliber and drill cartridge kit consists of:

- |                                       |                                     |
|---------------------------------------|-------------------------------------|
| 3 drill cartridges, 1 extra base.     | 1 pin wrench.                       |
| 1 subcaliber cartridge, 1 extra base. | 1 storage sheet.                    |
| 2 ejector springs.                    | 6 rotating pins.                    |
| 2 ejector spring screws.              | 1 graduated ring, with felt washer. |
| 1 cleaning rod.                       | 4 ring screws.                      |
| 1 eye-piece.                          | 2 closing cap set screws.           |
| 1 extension piece.                    | 6 stop pins.                        |
| 1 bristle cleaning brush.             |                                     |

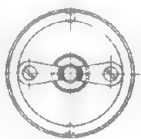
One subcaliber and drill cartridge kit is issued for each gun.



# DRILL CARTRIDGE

EJECTOR SPRINGS  
EJECTOR SPRING SCREW

REAR ADAPTER



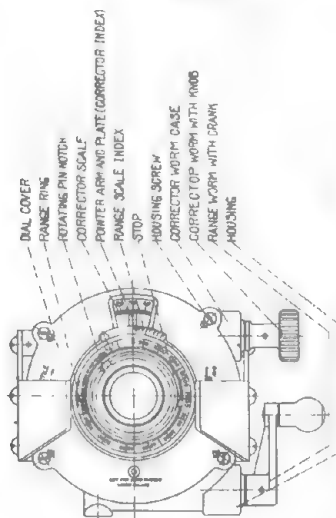
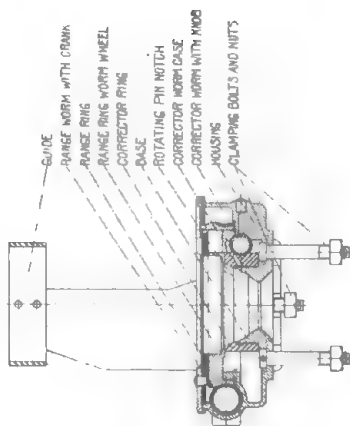
BASE SET SCREW

FRONT ADAPTER

BARREL CAL. 30



SUB-CALIBER TUBE



BRACKET FUZE SETTER MODEL OF 1916

## CARE OF CARTRIDGE CASES.

As soon after firing as practicable the exploded primers should be removed from the cartridge case by means of the decapping tool furnished with the reloading outfit. The case should then be thoroughly washed in a strong solution of soft soap and soda to remove all powder residue. It should then be thoroughly dried.

Before firing a salute with blank metallic ammunition all the cartridges to be used should be inserted in the gun to ascertain if they will fit. In preparing ammunition for salutes, a few rounds in addition to the required number should be prepared for use in case of misfires. Lightly oiling the outside of cartridge cases just before use will facilitate their insertion and extraction.

If the cartridge cases are carefully cleaned and washed immediately after firing, not only will less labor be required, but the life of the cartridge case will be prolonged. A good solution for washing cartridge cases may be prepared by using ingredients in the following proportions: One gallon of water, 2½ ounces soft soap, 5½ ounces soda. The mixture should be boiled and stirred until the ingredients are entirely dissolved.

In washing cartridge cases this solution should be used hot and in sufficient quantity to completely immerse the cases. Neither acids nor solutions of acids will be used for cleaning cartridge cases.

## MISFIRES AND HANGFIRES.

"Misfires" and "hangfires" are of exceedingly rare occurrence with this ammunition. In case of the failure of the cartridge to fire when the trigger is pulled, the breechblock *must not be opened* until after the expiration of at least one minute. The gun may be immediately tried again, but in doing this care should be taken that all parts of the body are out of line of recoil of the gun. Defective cartridges and primers should be reported.

## FUZE SETTERS.

### THE BRACKET FUZE SETTER, MODEL OF 1916-M.

(PLATE X.)

The bracket fuze setter is attached to the rear end of the fuze setter bracket on the caisson. It consists of the following principal parts: Base, housing, corrector-worm case, guide and range and corrector worms, rings and scales. The base is attached to the fuze setter bracket by four bolts. The housing, the corrector-worm case,

and the guide are each secured to the base by screws. These are the fixed parts of the instrument. The housing forms a cover for the movable parts and affords a seat for the range worm. The corrector ring and the range ring, worm wheel (which carries the range ring) are the movable parts of the fuze setter. When assembled, the interior surfaces of these two rings, in connection with the bore of the fuze setter base, form a socket, shaped to fit the exterior of the combination fuzes. Upon a portion of the exterior of the corrector ring is formed a segment of a worm wheel meshing with the worm seated in a fixed part of the instrument (the corrector-worm case), so that turning the worm rotates the corrector ring. A notch is cut in the inner surface of the corrector ring to take the rotating pin, which projects from the graduated time-train ring of the fuze.

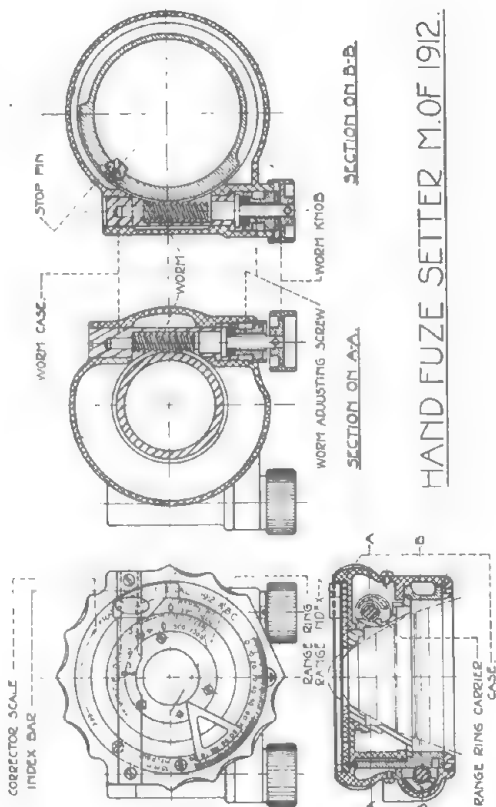
The pointer arm attached to the corrector ring carries at its upper end flush with the upper surface of the fuze setter, the pointer plate which is an index for the corrector scale. Suitable manipulation of the corrector worm moves the corrector ring until the index is set at any desired division of the scale.

The range-ring worm wheel is located within the housing and is mounted on the corrector worm case and ring, and the worm wheel formed on its exterior surface meshes with the range worm, seated in bearings in the housing. The range ring is attached by four screws to the upper surface of the range-ring worm and located by a pin. The ring may therefore be set at any desired reading by a suitable manipulation of the range worm.

The range ring is set for a given range when the division indicating that range is in line with the range scale index, which is the central division on the corrector scale (not the corrector index). The corrector scale is set for a given correction when the corrector index (which is movable) is opposite the specified division of the corrector scale.

When 0 on the range ring is set opposite the range scale index, which is engraved on the corrector scale, and the pointer arm index is opposite 30 on the corrector scale, the fuze will be set at 0. When setting a fuze to explode on impact, or for safe transportation, the "S" on the range ring should be set opposite the range scale index and the pointer arm index set opposite 30 on the corrector scale. Great care should be exercised in making this setting. To use the bracket fuze setter, set the range ring and corrector scale at the range and correction ordered by turning their respective worms; remove the weatherproof cover on the fuze by ripping off the soldering strip

# HAND FUZE SETTER.



HAND FUZE SETTER M.O.F 1912.

place the point of the projectile in the fuze setter with the rotating pin of the graduated time-train ring engaging its notch in the corrector ring; hold the projectile against the guide and while passing the fuze firmly into the fuze setter socket. Turn the projectile in a *clockwise* direction until the stop brings up against the side of the fixed stop pin in the body. Especial care must always be taken to rotate the projectile in a *clockwise* direction. When not in use fuze setter should be secured in its traveling position and protected by the fuze-setter cover issued for this purpose.

The range worm, range-ring worm wheel, corrector worm and the corrector ring should be removed from time to time and thoroughly cleaned and oiled. To disassemble, remove the taper pin from the crank and crank from the range worm; withdraw the worm. Unscrew the four housing screws and remove the housing and the range-ring worm wheel. Drive out the taper pin from the corrector-worm knob; remove the knob from the corrector worm and withdraw the corrector worm. Unscrew the worm-case screws and remove the corrector-worm case. Remove the corrector ring from base. Clean thoroughly, grease the worms and the gears, oil the bearings for worms, and assemble in reverse order.

#### HAND FUZE SETTER, MODEL OF 1912.

(PLATE XI.)

The hand fuze setter is a device for rapid and accurate setting of the fuze for various ranges and heights of burst. Plate XI shows assembled and sectional views and designation parts. The principal parts are the case, the range index mechanism, range mechanism, correction mechanism, and guide plate.

The case forms a housing for the movable parts and provides seats for the worm cases and the index bar. The slot, cut in the top of the case, limits the movement of the projecting segment of the corrector scale support which carries the corrector scale. The serrated rim forms a handle for turning. The arrow engraved upon the top and lower center edge of the case coincides with the graduations of the corrector scale. Two oil hole screws are located in the case directly under the serrated rim on both right and left sides.

The range index mechanism consists principally of the index bar, range index, index plunger and index spring. The index bar is retained in its seat, located in the case directly above the range ring corrector scale screws. On this scale is graduated 120 equal divisions, 50 minutes apart, numbered every 10 divisions. Graduation num-



ber 30 is the normal or zero position, and is indicated by an arrow. The word "turn" and an arrow engraved upon the corrector scale indicates the direction the fuze setter must be turned when setting a fuze. A pointer is riveted and soldered to the top of the corrector scale in a certain position to coincide with the graduated line on the closing cap of the fuze. The range ring carrier is seated in the corrector scale support. The worm teeth mesh with the threads of the worm on the right side of the fuze setter. The slot, which is cut in the bottom side of the range ring carrier, engages with the rotating pin in the graduated time train ring of the fuze. The interior is conical in shape to suit the exterior of the fuze.

The corrector scale support is held within the case by the guide plate. The worm teeth mesh with the threads of the worm on the left side of the fuze setter. The movement of the corrector scale support is limited in both directions by the slot in the case. The stop pin is secured in the interior of the corrector scale support by the stop-pin screw and engages with the fixed stop pin in the body of the fuze to limit the movement of the fuze setter.

The worms are mounted eccentrically in the worm cases which, when turned, provide an adjustment to take up the wear between the worm teeth of the range ring carrier or corrector-scale support, and the threads of their respective worms. The worm cases have screw driver slots at their rear ends, which are provided for adjusting and are locked in position by the worm case clamp plugs, which are secured by the worm-case clamp screws. The worm adjusting screws have fiber washers fitted in their ends that bear upon the collars of the worms for taking up end motion and to provide sufficient friction to resist accidental turning. A screw driver slot is located at their front end for adjusting. The worm-adjusting screws are locked in position by the worm-adjusting screw clamp plugs which are secured by the worm adjusting screw clamp screws.

The worm knobs are secured to the worms by taper pins. The exterior of the worm knobs is straight knurled to facilitate turning. The guide plate is screwed in its threaded seat in the bottom of the case and retained in position by the guide-plate lock screw.

#### DISASSEMBLING AND ASSEMBLING.

To disassemble, remove the index-bar mechanism, which is held in place by the two index-bar screws. Take out the three ranging screws and the two corrector-scale screws and remove the range ring and the corrector scale. Remove the guide-plate lock screw and unscrew the guide plate, using a teat wrench. To remove the

worm knobs from the worms drive out the taper pins. Loosen the worm adjusting-screw clamp screws which release the worm-adjusting screw clamp by two index bar screws and forms a slide for the range index.

The V-shaped notches in the index bar are marked with numbers 1, 2, and 3 with the word "Zone," which agree with the zones of the range ring. The range index sliding upon the index bar is held in position by the index spring, forcing the index plunger into the V-shaped notches of the index bar.

The range mechanism consists principally of the range ring, range-ring carrier, worm, worm case, worm-adjusting screw, and worm knob. The correction mechanism consists principally of the corrector scale, corrector-scale support, worm, worm case, worm-adjusting screw, and worm knob. The range ring is located upon the range-ring carrier by a steel dowel pin and secured in position by three range screws. The outer zone, or zone 3, is graduated for the "21-second fuze." Scales are graduated for ranges of 6,400 yards; least division is 50 yards and numbered every 500 yards. The data for graduating the range ring is computed from actual firings, and then corrected for a suitable height of burst on 3 mils. The graduated surface is sandblasted and lacquered.

The corrector scale is mounted upon the projected segment of the corrector-scale support and secured by two plugs. Remove the worm-adjusting screws. The worms can now be removed by turning. The corrector-scale support and range-ring carrier can then be removed. To remove the worm cases, loosen the worm-case clamp screws which release the worm-case clamp plugs.

Assemble in reverse order.

#### ADJUSTMENT.

Backlash or lost motion may appear between the collars of the worms and the fiber washers endwise; between the worm teeth of the range-ring carrier or the corrector-scale support and the threads of their respective worms. To remove the end backlash, loosen the worm-adjusting screw clamp screw, which releases the worm-adjusting screws clockwise, using a different screw driver until the end play is removed and there is sufficient friction to prevent accidental turning of the worms. The worm-adjusting screw clamp plugs must be firmly clamped after adjusting, by tightening the worm-adjusting clamp screws which secure the worm-adjusting screws against rotation.

Should backlash appear between the worm teeth of the range-ring carrier or the corrector-scale support and the threads of their respective worms, it can readily be removed by loosening the worm-case clamp screws, which release the worm-case clamp plugs, and then turning the worm cases, using a screw driver in a slot at the rear end in which the worms are eccentrically mounted so as to bring the worms in closer contact with the worm teeth. The worm-case clamp plugs must be firmly clamped after adjusting by tightening the worm-case clamp screws which secures the worm cases against rotation.

#### OPERATION.

First. Set the range index on the index bar to correspond with the fuze to be used.

Second. Turn the worm knob pinned to the worm and located at the front right side of the fuze setter, until the graduated line on the corrector scale which indicates the desired correction for height of burst, registers with the engraved arrow on the case.

The graduation numbered 30 and indicated by an arrowhead, is the normal height of burst under normal conditions. A decreased reading on the corrector scale decreases the height of burst and increases the range, and increased reading increases the height of burst and shortens the range.

To set a fuze, remove the waterproof cover, place the fuze setter over the fuze and turn until the slot in the bottom of the range-ring carrier engages with the rotating pin in the graduated time-train ring of the fuze. The guide plate and conical interior of the range-ring carrier will then rest upon the fuze. Turn the fuze setter clockwise, as indicated by the arrow on the corrector scale until the stop pin fastened to the corrector-scale support engages with the fixed stop pin in the body of the fuze and further motion is prevented.

The pointer, which is attached to the top of the corrector scale, should register with the gradual line on the closing cap, to indicate that the stop pin of the fuze setter and the fixed stop pin of the fuze are in contact. This pointer is added as the graduated time-train ring of the fuze has tendency to strike or bind to such a degree as to indicate that the stop pin of the fuze setter and the fixed stop pin of the fuze are in contact.

Cards for recording the results of tests of the fuze setters are furnished by the Ordnance Department for each size of gun, howitzer, or mortar, on which computed problems of inspection are given.





## 75-MM. GUN CARRIAGE, MODEL OF 1917 (BRITISH).

(PLATES XII, XIII, XIV, XV, XVI, XVII, XVIII.)

### WEIGHTS, PRINCIPAL DIMENSIONS, ETC.

Weight of carriage complete.....	pounds..	1,892
Weight of gun and carriage complete.....	do....	2,887
Weight at end of trail, carriage limbered.....	do....	96
Diameter of wheels.....	inches..	56
Width of track.....	do....	60
Length of recoil of gun on carriage.....	do....	49
Height of axis of gun.....	do....	36.86
Height of sight bar.....	do....	45.11
Maximum angle of elevation.....	degrees..	16
Maximum angle of depression.....	do....	5
Amount of traverse of gun on carriage.....	mils..	142

### DESCRIPTION.

The carriage is constructed to allow 16° elevation and 5° depression of the gun, which recoils axially in a cradle, the latter being fitted with a hydraulic buffer to limit the recoil to about 41 inches, and counter-recoil springs to return the gun to battery. The carriage is also constructed so that the elevation of the gun can be altered without interfering with the line of sight. It is provided with a seat on each side of the trail for two of the gun detachment, and with a shield for the protection of the men serving the gun.

The principal parts of the carriage are:

Trail.	Traversing gear.
Carriage body.	Firing gear.
Cradle.	Brake gear.
Hydraulic buffer.	Shield.
Counter-recoil springs.	Axletree and wheels.
Elevating gear.	Sights.
Range gear.	

#### Trail.

The trail is tubular and is secured to the axletree by a bracket, which also forms a pivot for the carriage body. The rear end is fitted with a spade, lifting handles, trail eye, and a traversing lever; the latter is folded down and held by a spring clip when not in use. Near its lower end is shrunk on a locking band; about its center is a band for the attachment of the brake arms and rear ends of tie rods, and in front of this again is a bracket with a dovetailed projection on which the rear end of the carriage body slides for purposes of traverse. The forward end of the trail is used for carrying the sponge staff and is closed by a door.

### **Carriage Body.**

The body consists principally of two triangular-shaped brackets connected by transoms and provided with bearings on the underside at the front, through which the axle-tree passes and by which it is pivoted for traversing. To the underside at the rear is fitted a bracket in which is formed a groove to fit over the traversing bracket on the trail. Bearings are fitted on the top front to receive the cradle trunnions which are held in position by trunnion caps.

An arc, which is used in conjunction with a clamp on the trail and body to lock the body to the trail in traveling, is fitted on the right side; it allows of adjustment of the clamp as required.

### **Cradle.**

The cradle is of bronze, with steel trunnions to pivot it to the carriage body, the left trunnion being prolonged and threaded for the reception of a stud for supporting the rocking bar sight; it has an opening in the lower portion for the gun and in the upper portion for the spring case. Longitudinal recesses are cut in the inner surface of the lower portion for the reception of the guides on the jacket of the gun. A steel guard is fitted to the left side to protect the gun layer, and a notch and point are formed above the spring case for rough laying.

### **Cradle-Clamping Gear.**

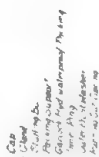
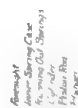
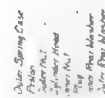
The gear is provided to clamp the cradle to the carriage body in the traveling position. A spindle with clutches and handle is fixed to the carriage body, so that when the gun is fully elevated the clutches may be made to engage with semicircular shaped lugs formed on the underside of the cradle and rigidly fix the cradle to the carriage. Two stops are fitted to the carriage body to limit the travel of the handle of the clutch spindle. This gear also determines the point of maximum elevation. In the event of the clamping gear becoming jammed and difficult to release it can be overcome by easing the lower elevating wheel by hand before unclamping.

### **Hydraulic Buffer and Counter-Recoil Springs. (PLATE XV.)**

The hydraulic buffer, which is contained in the spring case in the upper portion of the cradle, consists of a cylinder, piston with rod, control plunger, and stuffing box with gland. The cylinder is closed at the rear by the control plunger and at the front by the stuffing box and gland, which are locked in the required position by a spring stud. The cylinder is attached to the gun and secured by two nuts. A number of longitudinal grooves are formed on its inner surface, the depths of which are graduated so that the space







for the flow of the liquid between the piston and the cylinder varies during recoil; by this means an approximately constant pressure is maintained in the buffer throughout the stroke. The front end of the piston rod is fixed to the front of the spring case. The rear end is bored for the reception of the control plunger, which by displacing the liquid inside the piston rod brings the gun gently to rest when returning to battery.

A filling hole, closed by a plug with chain, is provided near the top rear end of the cylinder.

The buffer contains about  $4\frac{1}{2}$  pints of hydroline oil.

The counter-recoil springs surround the hydraulic buffer cylinder, and are inclosed in a steel case which is screwed into the cradle above the gun. They consist of two sets, inner and outer, which are held under initial compression between an external flange on the front end of buffer cylinder, and an internal flange at the rear end of the outer spring case; each set is divided into four sections, separated by parting plates; the inner and outer sets are also separated longitudinally by an inner case.

For the better detection of a leak in the gland, holes are bored in the spring cases; four holes near the rear end of the inner spring case, and two holes underneath, one at the front and one at the rear of the outer spring case.

*Action* - When the gun recoils on firing it draws the buffer cylinder with it to the rear; the liquid in the cylinder in passing from front to rear of piston, is forced through the grooves in the cylinder, which sets up an hydraulic resistance, so absorbing the energy of recoil and bringing the gun to rest. The shape of the grooves is such that the flow space gradually diminishes and by this means the stability of the carriage is never disturbed. Meanwhile the counter-recoil springs have been further compressed; their subsequent expansion causes the gun to return to the firing position, and in doing so the control plunger displaces the liquid in the rear end of the piston rod, the liquid escaping over the tapered flats which results in the gun being gently brought to rest in the firing position.

#### **Elevating and Range Gear. (PLATES XVI, XVII.)**

The elevating gear is divided into two portions, upper and lower, by the employment of a double-ended elevating screw, to the center of which a rod carrying a bracket to which the arc of the range gear and sights are attached.

The gears are so arranged that the elevation of the gun can be altered without altering the line of sight. The handwheel on the left of the carriage is for aligning the sight on the target (the range indicator remaining stationary), while the handwheel on the right side is

actuated until the required range is indicated on the yard-scale ring (the sight remaining stationary).

The range indicator is fitted to the right side close to the hand-wheel, and consists of a yard-scale ring graduated on its face in hundreds of yards; the periphery of the ring is graduated up to 16 degrees, with readings for every 10 minutes. (See footnote.)

The yard and degree scale ring is prevented from slipping by two woodite washers, placed one on either side of the ring. The washer on the inside bears between the ring and a spring case, and that on the outside between the ring and a jamming plate.

The gear is supported on a cross spindle which is held in bearings in the cradle. The left end of the spindle carries a pinion which works in the arc supported from the center of the elevating screw. The spring case contains a clock spring which eliminates backlash between arc and pinion.

A bracket is fastened to arc of the range gear. This bracket is provided with a seat for the panoramic sight carrier. This carrier is provided at its upper end with a slot and detent for holding and clamping the panoramic sight.

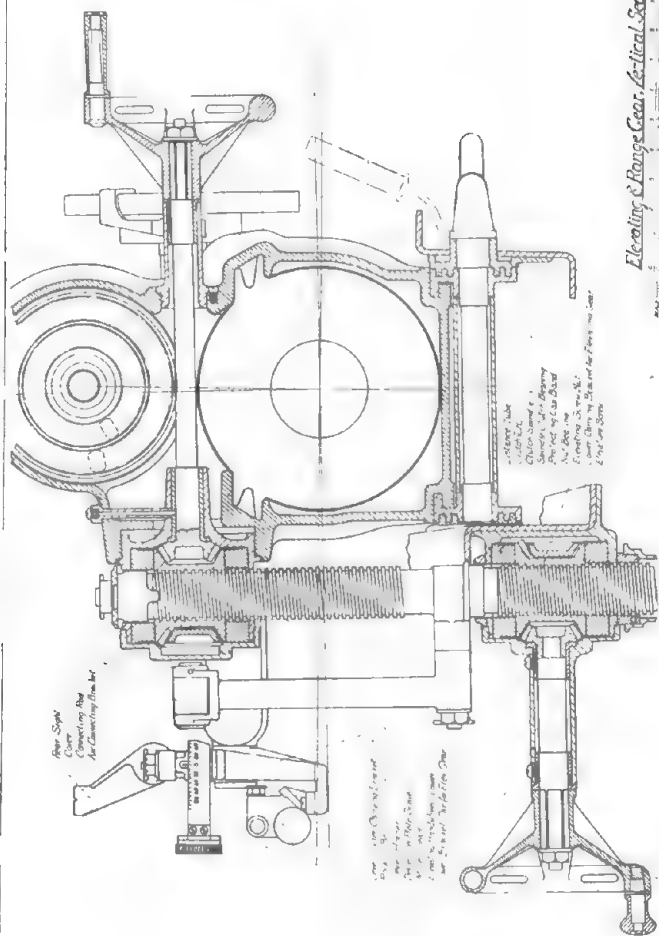
The sight carrier may be raised in its seat to permit sighting over the main shield. A clamp screw is provided for holding it in its proper position.

On coming into action (gun being in battery), release the clamping handles of the cradle and carriage body clamping gears, place the traversing pointer at  $0^{\circ}$ , and bring the gun to about the horizontal position by means of the left elevating handwheel. Either gear, elevating or range, can then be worked as required.

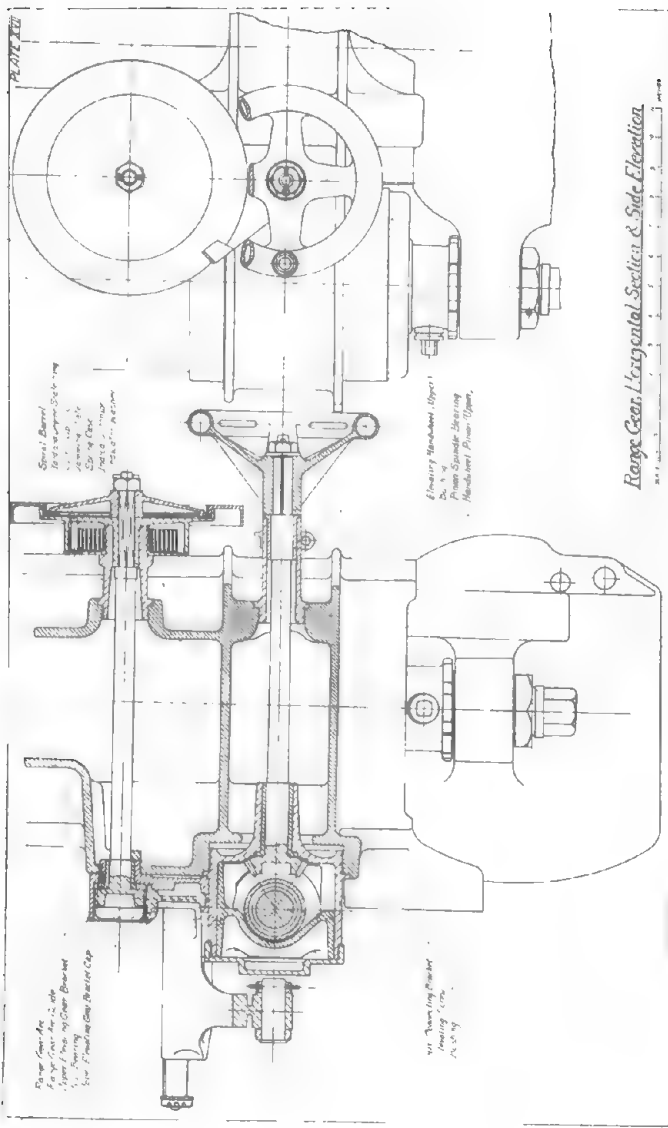
#### **Traversing Gear. (PLATE XVIII.)**

The traversing gear consists principally of a crosshead, link nut, and an actuating screw with a handwheel. The crosshead is pivoted vertically to the traversing bracket on which the rear end of the carriage body slides. The working parts are protected from dust by cotton packing packed around the outside of the link nut. The nut is linked to the carriage body, and by means of the handwheel on the end of the screw four degrees of traverse right or left can be obtained. A scale strip and pointer indicate the angle of traverse. The scale strip has black graduations on brass on the left and white graduations on a black ground on the right side of zero. A leather loop fixed to the cap of the lower elevating gear bracket is slipped over the handle of the handwheel to prevent the latter turning when traveling.

NOTE. The yard-scale ring is graduated according to the French-American system and not according to the British practice described above.



Lifting Range Gear Vertical Section



Range Gear Horizontal Section & Side Elevation.

Scale 1" = 1' 0"

**Firing Gear.**

The firing gear is arranged so that the cannoneer can fire the gun without altering his position when laying. It is attached to the left side of the cradle and consists principally of a connecting rod, connecting arm, and a spring lever, which engages with the trigger of the gun. The connecting arm is pivoted to a fulcrum on the cradle at one end; the other end is connected to a spring lever by the connecting rod, which is provided with a handle for operating the gear. After firing, the handle is returned by a spring attached to the lever and the guard protecting the cannoneer.

The gun can be fired when within 2 inches from the "in battery" position.

**Brake Gear.**

The tire brake is for use when traveling, and is always to be used when firing. It consists principally of two brake arms, two cranked levers, connecting rods, and an actuating screw. The brake arms are pivoted at one end to a bracket on the trail, and provided at the other end with the service cast-iron brake block, which acts on the wheels. Each of the cranked levers is pivoted to brackets on the axletree, one on each side of the carriage body; one arm of each lever is connected in front of the axletree by a connecting rod; the outer arm of the right-hand lever is provided with a nut, through which the front end of the actuating screw passes, the other end of the screw being linked to the right brake arm. The other arm of the left-hand lever is connected to the left-hand brake arm by a rod and eccentric link; a releasing lever, with an eccentric pivoted to the connecting rod and link, enables the brake to be quickly released when required. When traveling, the lever is secured by a quick release strap, and the connecting rod by a leather tie passed around it and the left tensile stay at the point of crossing.

The brake arms are actuated by the handle at the end, or by the cross handle near the center of the actuating screw.

**Shield.**

The shield is of armor plate. It is in three parts, the upper and lower portions of which are hinged. The main portion is attached to the axletree by supporting brackets, and to the trail by a flange with bolts. The lower portion for traveling is secured to the trail by a pawl, with a releasing lever and locking pin. The upper portion is lowered for traveling, or when using aiming points in conjunction with the panoramic sight in front of the battery. The panoramic-sight opening is provided with a hinged shutter for protection of

the gunlayer when the rocking bar sight is not in use; it is raised or lowered by a lever.

A sheet-steel box, with leather-lined packing blocks called the "panoramic-sight case" attached to the rear face (left side) of the main shield, provides a place for the panoramic sight in traveling. The spare-part case, which is made of a block of wood and entirely covered, is carried on the right side of the main shield. On this side of the shield is also a bracket for carrying the horizontal oiler.

#### **Axletree and Wheels.**

The axletree is a tubular steel forging; it passes through bearings on the carriage body and trail and is secured by a center pin which passes through the trail bracket and axletree, and two outside pins which pass through the brackets fitting over the axletree against the outside of the carriage body bearings, one either side, and the axletree itself. A bracket feathered to each shoulder of the axletree is recessed on its outer face for the reception of an L-shaped leather ring, which is secured by a steel plate. The L-leather envelopes the inner end of pipe box, and prevents the ingress of dirt. The outer end of each arm is fitted for a linchpin and an adjusting collar, which has a number of recesses (through which the linchpin passes) cut in one face; the recesses are of varying depths, from 0.2 to 0.5 inch, increasing by 0.05 inch, so that any reduction in the length of the pipe box, due to wear, may be adjusted.

The axletree is braced by a tie-rod on either side; the front ends of the rods are attached to the axletree brackets while their rear ends are bolted to the brake band on the trail.

The wheels are 4 feet 8 inches diameter, with steel flanges, removable box, and a 3-inch steel tire with rounded edges. The flanges are of corrugated steel, connected by bolts which pass through the ends of the spokes. The inner flange is fitted with a steel ring to strengthen it, and the other flange with a centering ring. The box passes through the center of the flanges, and is secured by a nut, which is prevented from working loose by a lock plate, which fits over the octagonal nut, and has two arms through which it is bolted to the flange. A cap is screwed on the outer end of the box; it incloses the adjusting collar, linchpin, and the end of the axletree arm. The inner face of the cap is recessed for the reception of a corresponding projecting ring on the nut, the cap being secured to the nut by a split pin. The box is provided with a lubricating hole, which is closed with a  $\frac{1}{2}$ -inch screw.

The drag washer is free to revolve round the nut, and is secured by the dust cap.





## CARE AND PRESERVATION OF CARRIAGES.

## CARRIAGE.

## TO REMOVE THE HYDRAULIC BUFFER AND SPRINGS (GUN IN BATTERY)

NOTE.—Care should be taken that no one is standing in front of the carriage while the operation is being carried out.

1. Place the gun at depression and remove the outer nut, securing buffer cylinder, which will allow the cylinder to bear against the outer spring case cap.
2. Attach the spring compressor to the buffer and take up the tension on the counterrecoil springs.
3. Remove the piston rod nut, the outer spring case cap, and filling plug.
4. Release gradually the spring compressor and the inner nut securing buffer cylinder as the springs are released.

When the springs are fully extended remove the spring compressor and remove the springs with parting plates, bearing washers, inner spring case, and buffer cylinder from the front, care being taken when removing the cylinder that the filling hole is kept upright to prevent loss of oil.

## TO REPLACE THE HYDRAULIC BUFFER AND SPRINGS.

1. Slightly depress the gun. Replace the rear washer at the end of the outer spring case with radius to the rear, and insert three of the outer springs and parting plates in correct order.
2. Insert the inner spring case with front washer (radius to the front) and one outer spring in position.
3. Place an inner spring with the rear washer in the inner spring case (radius to the rear), and insert two more inner springs with parting plates in the correct position.
4. Place the front washer (radius to the front) and the remaining inner spring on the buffer cylinder.
5. Attach the spring compressor to the buffer.
6. Replace the cylinder, care being taken that the filling hole is at the top and that the inner nut-securing cylinder is passed onto the spring compressor before the latter enters the lug of the gun. Replace the outer spring case cap and piston rod nut on piston rod (first seeing that the split pin retaining stuffing-box stud is placed in position and the point opened), care being taken to insure that the keyway in the cap engages the key on the end of the piston rod.
7. Compress the springs, care being taken that the keys on the end of the cylinder are in the correct position to enter the keyways in the

lug of the gun and that the inner nut-securing cylinder is correctly secured by screwing it up while compressing the springs.

8. Screw on the cap, remove the spring compressor, replace the outer nut-securing cylinder, and the filling plug.

*In removing and replacing the recoil cylinder, the gun must be kept at depression or properly secured.*

NOTE. - When the gun fails to counterrecoil correctly it is probably due to any of the following causes:

- (i) Weak or broken springs.
- (ii) Dirt or want of lubrication on either gun guides or cradle guideways.
- (iii) Distortion of either the guides or guideways.
- (iv) Buffer gland screwed up too tightly.
- (v) Too much oil in buffer; or, if the gun remains practically at full recoil.
- (vi) Front flange of inner spring case is broken.

If the instructions given on page 42 for filling the buffer have been carefully carried out, excess of oil will only appear after rapid and continuous firing, due to the raising of the temperature of the oil, and, therefore, oil should not be removed from the buffer until it has been decided, by the elimination of the other causes, that the failure to run up is due to excess of oil.

When this has been decided, the gun should be brought to the horizontal position and the buffer unscrewed sufficiently to allow the excess of oil to escape. This oil should be caught in some clean receptacle, and returned in the usual manner to the buffer when the latter has again cooled down. Great care must be taken to screw home tightly the buffer after the heated oil has been extracted. The amount of oil to be withdrawn will be determined by the gun moving forward to its correct position.

In case (vi) when the failure to counter recoil is due to the breakage of the spring case, special precautions will have to be taken when removing the buffer and springs, and are as follows:

(1) Place the gun at depression and run it back to a distance of about 43 inches from the cradle (metal to metal), the breech being supported on the trail on skidding.

(2) The piston rod nut should *not* be removed.

(3) Secure a rope to the lug on the breech ring of the gun and man it toward the rear by four men. This will remove the pressure of the outer springs from the threads of the cap on the outer spring case. While the rope is manned, unscrew the cap, taking care to keep clear of the muzzle.

(4) Ease up the pull on the check rope, and allow the gun to run up gradually; at the same time, the motion should be assisted by relieving the weight of the gun at the rear. The outer springs will then have extended to their normal condition.

(5) Remove the piston rod nut, cap, the front broken portion of inner spring case and one outer spring, care being taken not to bend the piston rod.

6. Run the gun to the firing position and remove the inner springs and the remaining outer springs by attaching the spring compressor, this operation being similar to that before detailed, except that when the inner nut is removed the initial compression of the inner springs will tend to force the gun to the rear about 10 inches. A light drag rope should be used to prevent this.

PRECAUTIONS TO BE OBSERVED TO PREVENT VIOLENT RECOILS AND  
CONSEQUENT DAMAGE TO THE CARRIAGE.

1. Before going into action the rings, packing, hydraulic buffer should be carefully examined and changed if defective.

2. When tightening up a packing ring, the gland should not be screwed home, metal to metal, in the stuffing box. If the packing can not be made tight without doing this, a fresh packing must be used or an additional thin ring packing put in.

3. Buffers should be correctly filled before going into action, and examined from time to time to see that they are full.

4. As often as opportunity permits, the gland should be examined and, if necessary, screwed up when the buffer is hot from firing. The packing is then very plastic and is easily squeezed to make a good joint.

5. If, during firing, oil is being lost from the buffer and recoil becomes excessive, the packing ring must be either renewed or adjusted; otherwise the gun will most certainly be put out of action in a short time, and most probably the buffer will be damaged.

NOTE.—Spare packing rings soaked in tallow should be kept ready for immediate use.

TO TIGHTEN OR RENEW THE PACKING.

If any leakage of oil takes place at the gland, the packing should be tightened; if this will not stop the leak, the packing must be renewed.

TO TIGHTEN THE PACKING (GUN IN POSITION).

1. Remove the piston rod nut and outer spring case cap.

2. Screw up the gland with the spanner No. 122. While in use the spanner must be kept against the face of the gland in order to disengage the retaining stud. The position of the gland after screwing up must permit of the retaining stud reengaging with a slot in the gland.

3. Replace spring case cap and piston rod nut, taking care that the key on the piston rod and the keyway in the cap are properly engaged.

TO RENEW THE PACKING RING IN THE STUFFING BOX (GUN IN POSITION).

1. Empty the cylinder at the buffer, and replace the buffer.

2. Unscrew and remove piston rod nut and front cap. Then unscrew the gland and withdraw the outer ring, supporting packing with the tools supplied, and replace the packing with fresh material, using the metal collar of the packing tools to assist the packing ring over the shoulder of the piston rod. Replace the supporting ring, gland, and cap, and refill the cylinder.

If there is any difficulty in removing the old packing from the stuffing box, the latter should be removed from the buffer and the packing removed by inserting the plug of the packing tool into the stuffing box and driving the packing out.

NOTE.—If the gun is not in position, the "spring compressor" must be attached to the control plunger before the cap is removed.

*Split pin securing stud retaining stuffing box.*—On the inserting and opening out this pin, care must be taken to see that the retaining stud when pushed right back clears the flange of the stuffing box to permit of its removal. The head and point of the pin should be set to the front if necessary to clear the end of the slot and to allow the stud to go back far enough to clear the stuffing box.

*To fill the buffer.*—(Quantity of hydroline oil, about  $4\frac{1}{2}$  pints.)—Place the gun at extreme depression, remove the filling plug, unscrew the control plunger two turns, to admit of the escape of air, and fill the cylinder, using funnel. After filling the cylinder about one-tenth of a pint of oil should be extracted. Replace the plug and tighten the buffer. Great care must be taken that no dust or gritty matter is poured in with the oil.

NOTE.—After filling and before any oil is drawn off, the filling hole plug should be left out for about 15 minutes, if time permits, and the cylinder again examined to see that it is properly filled.

ALTERNATIVE LIQUIDS WHICH MAY BE USED IN THE CYLINDER IN CASE OF EMERGENCY.

1. Pure glycerine or a mixture of equal parts of glycerine and water.

2. Any heavy lubricating oil.

3. Soapy water, or water containing a proportion of soda.

4. Clear water may be used in a great emergency only, but it should on no account be allowed to remain in the cylinder for longer than is absolutely necessary, on account of its rusting action.

Kerosene, paraffin, or similar burning oils, must on no account be used for this purpose.

## GENERAL INSTRUCTIONS.

### ELEVATING GEAR.

In replacing the bearings and elevating nuts, care must be taken that the open side of the bearing is inserted first in the upper gear, and the closed side first in the lower gear (with the teeth of the elevating nuts at the top in both cases), so as to insure that the gun is always elevated by revolving the handwheels toward the rear, or depressed by revolving the handwheels toward the front.

### RANGE INDICATOR.

The yard and degree scale should be kept perfectly clean, free from grit, burrs, or dents, and the revolving surfaces slightly greased.

In replacing the eccentric bushing in the arc guides, care must be taken that the bushing is placed in such a position as to insure the least possible play between the teeth of the pinion and the elevating arc. The grooves in the eccentric bushing which engage the stop pin are arranged to give eight adjustments, which are numbered 1 to 8, Nos. 1 and 8 representing the minimum and maximum setting, respectively.

A certain number of bushings have the grooves numbered 1 to 8, but Nos. 1 and 5 indicate the minimum and maximum setting, respectively.

The order of adjustment for each pattern bushing is as follows:

	Nos. 1 and 8, mini- mum and maximum.	Nos. 1 and 5, mini- mum and maximum.
First adjustment.....	1	1
Second adjustment.....	2	2
Third adjustment.....	3	3
Fourth adjustment.....	4	3
Fifth adjustment.....	5	7
Sixth adjustment.....	6	4
Seventh adjustment.....	7	6
Eighth adjustment.....	8	5

## TO REMOVE THE INDICATOR.

Remove the rocking bar sight and disconnect the rod connecting elevating screw at the arc joint; withdraw the arc until it is out of gear with the pinion, holding the spring case by hand while doing so; gradually release the tension (by hand) on the spring by allowing the spring case to revolve slowly, so as to prevent the breaking of the spring, and remove the indicator from the spindle.

## TO REPLACE THE INDICATOR.

Remove the jamming plate, the two woodite washers, and yard scale ring; place the spring barrel on the bearing on the cradle, and the spring case with spring on the spindle; turn the spring case by hand to the front until the spring is at full tension, release the spring case about a quarter of a turn, and engage the arc and connecting rod; replace the yard scale ring, washers, and jamming plate. Replace rocking bar sight and adjust the yard scale ring to the horizontal plane of the gun.

## BRAKE GEAR.

When the brake is applied, the releasing lever must be pushed forward to a horizontal position.

Any wear in the eccentric can be adjusted by screwing up the connecting bolt of the link eccentric.

When assembling the "lever, releasing brake," the hexagon on the spindle portion of the lever must be placed in the eccentric so as to give the maximum amount of throw.

## TRAVERSING GEAR.

The pivot of the crosshead should be kept properly screwed up, and any lateral play in the traversing screw adjusted by tightening the crosshead cap and the check nut.

## CLAMPING GEAR FOR CARRIAGE BODY.

This clamp should always be on when traveling. To put on the clamp, the lever is pulled to the rear, which tightens the nut and draws the carriage down to the trail, thus making it difficult to turn the traversing handwheel.

If, owing to the wear, the lever can not be moved sufficiently to tighten the clamp properly, it must be moved to another position on the octagonal nut.

In action the lever must be pushed as far forward as possible.

### GEAR, CLAMPING CRADLE.

Care should be taken that the handle of the clutch spindle is always against the stops when not in use.

The cradle can only be clamped when the gun is at extreme elevation. The gear is intended for use when traveling only.

In replacing the clamping gear the clutches (which are left and right) must be correctly placed on the spindle, i. e., the thinnest portion of the eccentric being to the front, and both in the same relative positions on the spindle, so as to engage the bearing on the cradle at the same time.

### PIN, LOCKING SHIELD PAWL.

It should be carefully noted that this pin is always in proper position when traveling.

### WHEEL.

The wheel is fitted with dust cap, which can be removed with a No. 93 spanner; lateral play between end of box and linchpin can be adjusted by means of an adjusting collar with slots, through which the linchpins pass; the slots vary in depth from 0.2 to 0.5 inch; the difference in depth between each slot allows for a wear of 0.05 inch.

### SIGHTS.

Great care must be taken not to damage the sights when removing or replacing. The parts of the carriage to which the sights are attached must be absolutely clean and free from burrs.

### DEFLECTION SCREW AND NUT.

Should be kept free from grit and dirt and should be well greased, and if removed for any purpose care should be taken in replacing that the spring in the nut (the latter being in halves) is properly compressed before entering the screw. The spring fitted in the deflection nut, to obviate backlash, may be found stronger than is necessary for its work, the result being stiffening and increased wear on the screw. The spring should require a weight of 5 to 7 pounds to compress it to 0.9 inch.

### ADJUSTING BUSHING.

To be kept clean and well oiled, and if removed for any purpose steps should be taken to have the sight adjusted to the vertical plane of the gun.

## YARD SCALE RING.

This should be kept clean and oiled, and if removed for any purpose on replacing it should be set to the horizontal plane of the gun and sight.

## CAP SQUARES.

To remove cradle cap squares for cleaning, etc., the carriage body must be traversed as far as it will go to the left to admit the right cap square key being removed, and to the right to remove the left key.

## TO REMOVE THE OUTER SPRING CASE FROM CRADLE.

1. Dismount the gun.
2. Carefully remove the buffer, consisting of the cylinder, piston rod, inner and outer springs, and inner spring case.
3. Remove the upper protectors (curved), rough foresight, upper handwheel pinion spindle of the elevating gear, and the indicator pinion spindle of the range gear.
4. Unscrew the spring case (by means of a rope and a handspike, or other suitable appliance). Care must be taken, when the first portion of the thread of the spring case is disengaged from the cradle, that the second portion of the thread is properly entered and not cross-threaded; also that the threads are clean and lubricated.

## TO REPLACE THE OUTER SPRING CASE.

1. The converse of the above action takes place in reassembling the spring case and recoil cylinders.
2. Before mounting the gun the "protector slide" on the front end of the cradle should be removed to prevent the leather portion of the protector forcing out the metal and breaking off the screws when sliding the gun home.
3. After the gun is mounted, replace the "protector slide."

## REPLACEMENT LIMITS OF COUNTERRECOIL SPRINGS.

The normal free length of each counter recoil spring is as follows:

Inner.....	18.58 inches.
Outer.....	19.65 inches.

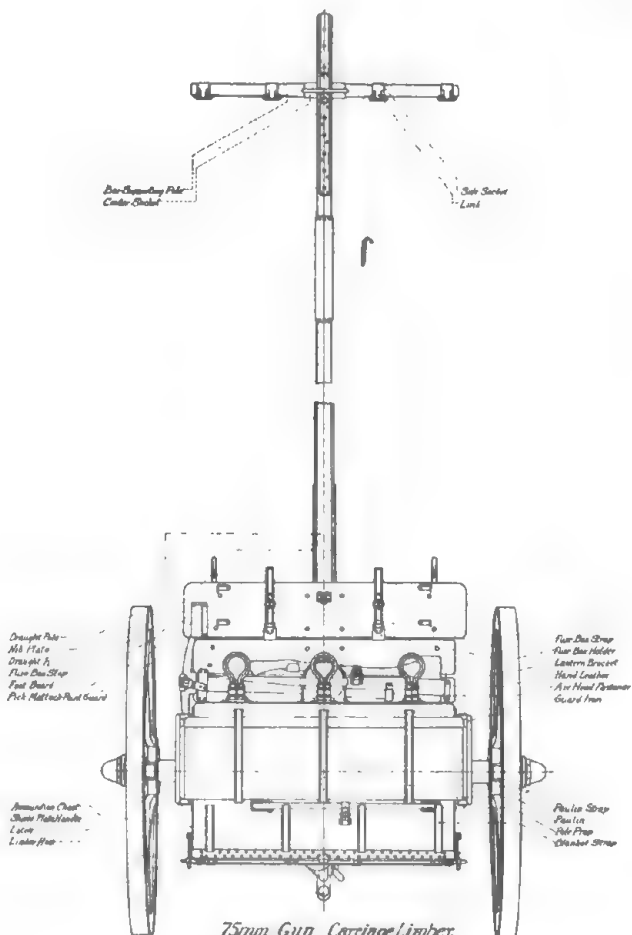
Any one spring, inner or outer, found with a permanent set of  $1\frac{1}{4}$  inches or more below the normal free length of the spring, will be replaced.

*The strictest compliance with the above instructions can not be over-estimated.*

In all reports and correspondence the gun and carriage should be designated as given on the name plates.







75mm Gun Carriage Limber

Model of 1917 (British)

Plan

*List of lubricating holes.*

Fittings which are provided with oil holes for lubricating purposes.	Number of holes.	Position of holes.
<b>CARRIAGE.</b>		
Cap squares (2).....each..	1	
Carriage body:		
Bearings, axletree (2).....do....	1	In lubricating cup, 1 on each side.
Bearings, clutch spindle (2).....do....	1	Inside carriage body, 1 on each side.
Cap, lower bracket of elevating gear...	2	In bearing portion for handwheel spindle on left side.
Cradle: Body.....	8	7 in sides for oiling sliding surfaces, and 1 on left side at rear, with tube for lubricating handwheel spindle.
Bearing, pinion, spindle handwheel...	1	On right side close to handwheel.
Gear brake:		
Bolts connecting—		
Cranked levers (3).....each..	1	2 on left side and 1 on right, close to shield.
Eccentric link.....	1	In head of bolt, right side, near brake blocks.
Fork actuating screw.....	1	In head of bolt, left side, near brake blocks.
Fork, actuating screw.....	1	On right side.
Link, eccentric.....	1	On left side.
Gear, elevating: Rod, connecting elevating screw.	1	In lower end.
Gear, firing:		
Arm, connecting.....	1	In upper end, left side.
Rod, connecting.....	2	1 at each end, left side.
Bracket, connecting arc, range gear...	1	On left side.
Bolts connecting brake arms (2) each.	1	In head of each bolt.
Crosshead, traversing gear.....	1	
Lever, traversing.....	1	At jointed end of lever, near plunger.
Sight, rocking bar.....	1	For oiling arm trunnion supporting sight.
Wheels.....	1	In inner flange.

**75-MM. CARRIAGE LIMBER, MODEL OF 1917 (BRITISH).****WEIGHTS, DIMENSIONS, ETC.**

(PLATES XIX, XX, XXI.)

Weight, complete, empty.....	pounds..	1,055
Weight of tools and equipment carried.....	do....	150
Weight of ammunition carried (shraonell).....	do....	431
Weight, completely equipped and loaded.....	do....	1,636
Weight of gun, carriage and limber, completely equipped with 21 rounds of ammunition.....	pounds..	4,523
Diameter of wheels.....	inches..	56
Width of track.....	do....	60
Turning angle with carriage.....	degrees..	70

**DESCRIPTION.**

The limber consists of a steel frame, a limber hook, an axletree, pole, an ammunition box, and two wheels.

The frame consists of four futchels, connected at the front end by a trough-shaped splinter bar, and at the center by braces. Plat-

form and footboards are fitted to the top, and draft hooks for the swingletrees to the front of the outer futchels. A steel limber hook is riveted to the rear end of the inner futchels.

The axletree is of weldless steel tube; it is fixed by flanges to the futchels. The linchpin and adjusting collar are similar to those for the carriage.

The pole fittings consist of a pole, a neck yoke, and two swingle-trees. The pole and bar are for use with the pole breast harness. The pole is 12 feet 4½ inches in length over all; the front end is protected by steel wrapping plates; a U-shaped tug is passed through the hole from the underside and secured by a nut on the top. The tug forms a stop for the neck yoke and its position from the point of the pole may be varied, according to requirements. The pole bar is fitted at the center with an oval loop, formed to pass over the front end of the pole and butt against the tug. Two links are fitted on each side of the loop, by means of which the bar is attached to the neck piece of the harness.

The ammunition box is of steel, and opens at the rear; it is constructed to carry 24 rounds of "fixed" ammunition, is fitted with guards, is secured to the frame by rivets, and supported by side connecting plates and gusset plates. Internally it is fitted with perforated diaphragms to carry 75-mm. ammunition. A compartment is formed in the center for two wood trays for small stores. The lid is hinged to the bottom of the box, and is provided with a shield plate of the same width, which hangs vertically below the lid when opened. The shield plate is hinged to the lid, and, when closed, the former is folded over the latter, which is secured by catches on each side of the box.

The limber is fitted for carrying three tubular oil cans and bucket holders for three canvas watering buckets.

The wheels are the same as those described for the carriage.

## THE 75-MM. GUN CAISSON LIMBER, MODEL OF 1918.

### WEIGHTS, DIMENSIONS, ETC.

(PLATES XXII, XXIII.)

Weight complete, empty.....	pounds..	987
Weight of tools and equipment carried (oil cans filled).....	do....	113
Weight of ammunition carried.....	do....	675
Weight, completely equipped and loaded.....	do....	1,775
Rounds of ammunition carried in limber chest.....	number..	39
Diameter of wheels.....	inches..	56
Width of track.....	do....	60
Free height under limber.....	do....	24
Turning angle with caisson.....	do....	81



## Nomenclature of parts.

No.	Name of part.	Location, etc.	Property classification.	
			Class.	Section.
2	Wheels and wheel fastenings complete.	Same as on caisson.....		
1	Middle rail (upper and lower half), consisting of—	Riveted to chest bottom.....		
1	Doubletree bolt.....	In top of pole clamp.....		
1	Doubletree nut.....	On doubletree bolt.....		
1	Doubletree strap.....	Riveted to middle rail.....		
1	Pole clamp.....	do.....		
1	Pole-clamp bolt.....	In pole clamp.....		
1	Pole-clamp nut.....	On pole-clamp bolt.....		
1	Pole pin.....	Secures pole in seat.....		
1	Pole-pin reinforce plate.....	Riveted to middle rail at pin.....		
1	Pole stop.....	Riveted in middle rail.....		
1	Prop bracket.....	Riveted to pole clamp.....		
1	Axle.....			
2	Axle bracket.....	Clamped to axle.....		
1	Side rail, right.....	Riveted to axle bracket, right.....		
1	Side rail, left.....	Riveted to axle bracket, left.....		
1	Name plate.....	Riveted to middle rail near pintle.....		
1	Limber prop, consisting of.....	Assembled to middle rail by means of prop bracket.....		
1	Prop chain.....	Fastened to prop tube.....		
1	Prop-chain fastening.....	Riveted to prop tube.....		
1	Prop-chain handle.....	On free end of chain.....		
1	Prop eye.....	In top end of prop tube.....		
1	Prop foot.....	In lower end of tube.....		
1	Prop tube.....	Hinged to pole clamp by prop eye.....		
1	Front tie rod, right.....	Ties middle rail and axle bracket.....		
1	Front tie rod, left.....	do.....		
1	Rear tie rod, right.....	do.....		
1	Rear tie rod, left.....	do.....		
6	Tie-rod pins.....	Fasten ends of tie rod.....		
1	Doubletree, consisting of.....	On doubletree bolt.....		
1	Doubletree body with reinforce.			
10	Separators.....			
1	Nipple separator.....	Riveted together.....		
1	Double hook, right.....			
1	Double hook, left.....			
1	Doubletree nipple.....	Renewable.....		
1	Nipple nut.....			
2	Doubletree rods.....	From doubletree to axle brackets.....		
2	Chains, doubletree rod.....	On doubletree rods.....		

IV

3

REC

1 1910

## Nomenclature of parts—Continued.

No.	Name of part.	Location, etc.	Property classification.	
			Class.	Section.
1	Foot rest, consisting of.....	Riveted to side rails.....		
2	Foot-rest plates.....	Riveted to front of foot rest...		
1	Hole reinforce.....	Riveted to foot rest at prop chain.		
1	Pick-handle fastener.....	Riveted on foot rest.....		
1	Pick-mattock point guard.....	Riveted to foot rest.....		
1	Pole-prop pocket.....	do.....		
1	Pole-prop support.....	do.....		
1	Prop-chain button.....	do.....		
1	Prop-chain button rivet.....	do.....		
1	Shovel-handle support.....	Riveted under foot rest.....		
1	Strap fastener No. 1.....	For pickax strap.....		
1	Strap fastener No. 2.....	do.....		
1	Pintle with bearing, complete, consisting of—	At rear end of middle rail.....		
1	Guide bolt.....	In middle rail behind axle.....		
2	Lock plates.....	Lock trunnion and pintle-bearing bolts.		
1	Pintle.....	Seated in pintle bearing.....		
1	Pintle bearing.....	Pivoted in guide.....		
2	Pintle-bearing bolts.....	Bolt guide to middle rail.....		
1	Pintle-bearing guide.....	In rear end of middle rail.....		
1	Pintle-bearing spring.....	In pintle bearing.....		
1	Pintle latch.....	On pintle.....		
1	Pintle-latch pin.....	Pins latch to pintle.....		
1	Pintle-latch spring.....	On pintle.....		
1	Pintle nut.....	On pintle shank.....		
1	Pole-supporting spring.....	Around spring rod.....	IV	3
1	Sleeve.....	On pintle shank.....		
1	Spring rod.....	In middle rail behind axle.....		
1	Spring-rod nut.....	On spring rod.....		
1	Spring-rod pin.....	Pivots spring rod to pintle bearing.		
2	Trunnion bolts.....	In pintle-bearing guide.....		
2	Handy ollers.....	For trunnion bolts.....		
1	Pole complete, consisting of—			
1	Butt reinforce.....	On rear end of pole.....		
1	Neck-yoke chafing plate.....	On pole at neck yoke.....		
1	Neck-yoke counter stop.....	At front end of pole.....		
1	Neck-yoke counter-stop pin.....	do.....		
1	Neck-yoke counter-stop spring.....	do.....		
1	Neck-yoke stop.....	do.....		
1	Pole body.....	Seated in front end of middle rail.		
1	Pole plug.....	In front end of pole.....		
1	Pole-pin bushing.....	In pole body at pin.....		
1	Ammunition chest, complete, consisting of—			
39	Ammunition-chest connecting pieces.	Rolled into rear and middle diaphragms.		
1	Ax-handle support.....	Riveted to right side of chest.....		
1	Ax-head fastener.....	do.....		
1	Bottom plate, right.....	Forms part of chest bottom.....		
1	Bottom plate, left.....	do.....		

## Nomenclature of parts—Continued.

No.	Name of part.	Location, etc.	Property classification.	
			Class.	Section.
1	Box holder, lower right.....	Riveted to foot rest.....		
1	Box holder, lower left.....	do.....		
4	Box stop, outer.....	do.....		
2	Box stop, inner.....	do.....		
1	Box holder, upper.....	do.....		
1	Box stop, upper.....	Riveted to box holder, upper.....		
1	Bucket holder.....	Riveted to bucket-holder transoms.....		
2	Bucket-holder transoms, right.....	Riveted to top of chest.....		
2	Bucket-holder transoms, left.....	do.....		
2	Chains, door.....	Fastened to door and handrail shanks.....		
2	Chains, No. 11.....	Fastened to door.....		
4	Diaphragm reinforces.....	Riveted to diaphragms at side rails.....		
1	Door.....	Forms back of chest.....		
2	Door-chain fasteners.....	Riveted to door.....		
1	Door frame.....	do.....		
4	Door hinges, male.....	do.....		
4	Door hinges, female.....	Riveted to bottom of chest.....		
1	Door-handle bar.....	In base.....		
2	Door-handle bases.....	Riveted to chest door.....		
4	Door-hinge pins.....	In hinges.....		
1	Front diaphragm.....	Inside chest.....		
1	Front plate.....	Forms front of chest.....		
1	Front transom, right.....	Riveted to diaphragms.....		
1	Front transom, left.....	do.....		
1	Handrail forward bracket, right.....	Riveted to side of chest.....	IV	3
1	Handrail forward bracket, left.....	do.....		
1	Handrail rear bracket, right.....	do.....		
1	Handrail rear bracket, left.....	do.....		
2	Handrail tubes.....	Riveted to hand-rail brackets.....		
1	Hatchet-blade bracket.....	Riveted to left side of chest.....		
1	Hatchet-handle fastener.....	do.....		
1	Hatchet-handle rest.....	do.....		
1	Lantern-bracket body.....	Riveted to front plate.....		
1	Lantern-bracket bottom.....	Riveted to bracket body.....		
2	Lantern-strap fasteners.....	do.....		
2	Lock bars.....	Hinged in lock-bar bearings.....		
2	Lock-bar bearings, right.....	Riveted to top plate.....		
2	Lock-bar bearings, left.....	do.....		
1	Middle diaphragm.....	Inside chest.....		
2	Middle transoms, right.....	Riveted to diaphragms.....		
2	Middle transoms, left.....	do.....		
1	Padlock, No. 850.....	Chained to door.....		
1	Pick guard, chisel point.....	Riveted to left side of chest.....		
1	Pick-head fastener.....	do.....		
1	Rear diaphragm.....	Inside chest.....		
1	Rear transom, inner, right.....	Riveted to diaphragms.....		
1	Rear transom, inner, left.....	do.....		
1	Rear transom, outer, right.....	do.....		
1	Rear transom, outer, left.....	do.....		
78	Reinforce pieces.....	Soldered to connecting pieces.....		
1	Shovel-handle bracket.....	Riveted to bottom of foot rest.....		
5	Strap fasteners, No. 1.....	For ax and paulin straps.....		
7	Strap fasteners, No. 2.....	For boxes.....		



*Nomenclature of parts—Continued.*

No.	Name of part.	Location, etc.	Property classification.	
			Class.	Section.
16	Strap fasteners No. 5.....	For blanket and plakat-rope straps.	IV	3
3	Strap fasteners, No. 7.....	For grip and paulin straps....		
1	Strap fasteners No. 10.....	For boxes.....		
3	Strap fasteners No. 12.....	For hatchet and shovel straps.		
1	Top plate.....	Forms top and sides of chest..		
2	Top plate front fillers.....	Riveted to side rails.....		
2	Top plate rear fillers.....	do.....		
2	Wing nuts.....	Fastened to door plate.....		
2	Wing-nut pins.....	Riveted to door plate.....		
2	Wing-nut pin washers.....	On wing-nut pins.....		

**DESCRIPTION OF GUN CAISSON LIMBER.**

(PLATES XXII AND XXIII.)

The limber is of metal throughout, excepting the spokes and fellows of the wheels. The principal parts of the limber are the wheels, axle, frame, ammunition chest, pole, doubletree, singletrees, and neck yoke.

The wheels are the same as and interchangeable with those on the caisson.

The axle is of forged steel, made in one piece.

The frame consists of a middle and two side rails. The middle rail is in the form of a split cylinder, one half passing below and the other half above the axle. The two halves are united in front to form a pole seat and in rear to form a seat for the pintle-bearing guide. Two axle brackets are clamped about the axle near the axle arms with two bolts each, and are provided with lugs. Tie rods, two in front and two in rear, are pinned to these lugs and attached to the front and rear ends of the middle rail, bracing the pole and pintle seat. To the front end of the middle rail is riveted the pole clamp, a steel collar, split on one side and provided with a clamping bolt for drawing the two halves of the middle rail firmly about the pole. A seat for the doubletree is formed on top of the pole clamp; the doubletree bolt projects up through this seat and through the doubletree; its upper end is threaded for a nut and is braced back to the middle rail by a doubletree strap. Riveted to the lower side of the pole clamp is the prop bracket, which is connected to the prop,





## VERTICAL SECTION



a steel tube provided with a bronze foot, by the prop eye. When not in use, this prop is swung up under the frame by a chain, which is attached to the lower end of the tube by a prop-chain fastening, and reaches up through the foot rest, where it terminates in a prop-chain handle. It is held in the raised position by hooking the handle over a prop-chain button provided on the foot rest for that purpose.

When limbered up with another vehicle, this limber has in its pintle and pintle bearing an automatic pole support. The pintle hook has a lug formed on its lower side, which projects backward and bears against the underside of the lunette on the drawn vehicle, thus preventing the vertical rotation of the pintle. The pintle-bearing guide is a steel yoke fixed in the rear end of the middle rail. The pintle bearing is of bronze, pivoted to the guide by two trunnion bolts; it is bored out to receive the shank of the pintle and is counter-bored in front for the pintle-bearing spring. The latter, assembled about a sleeve fitting over the pintle shank, is compressed between a pintle nut and the pintle bearing, and absorbs the shock of starting. The sleeve checks the movement of the pintle nut before the spring becomes compressed solid. On top of the pintle bearing is formed a lug, to which is pinned one end of a spring rod, the other end of which is threaded for a spring rod nut and slotted to receive a guide bolt that passes through the middle rail near the axle. This spring rod, guided in the rear by a vertical wall of the pintle-bearing guide, through which it passes, and in the front by the guide bolt through the slot, as stated, is drawn backward by the relative action of the pintle bearing on its trunnions, compresses the pole-supporting spring, which is assembled about it, between the spring rod nut and the vertical wall of the pintle-bearing guide. When the limber pole is dropped, the pintle tends to rise. Being held down, however, by the lunette in it, the pintle bearing is forced to swing on its trunnion bolts and draw the spring rod backward, thus compressing the pole-supporting spring until the reaction of the spring is sufficient to support the pole.

The pintle is similar to that on the gun caisson.

The side rails are of channel shape, fitting down over the axle brackets and riveted thereto. The rear ends project slightly behind the chest to form steps for the use of cannoneers in mounting; the front ends are bent up to support the foot rest. To the middle portions are riveted the chest, which they support, and of which they form a part of the bottom. The foot rest is a perforated sheet of flange steel formed to shape and riveted to the side rails.

The ammunition chest is a rectangular steel box built up of sheet steel, riveted together. The front plate is flanged all around and is riveted through the flanges to the top plate, which forms the top, sides, and part of the bottom of the chest. The remainder of the bottom is formed by two bottom plates and by the side rails. The door is made of a steel plate riveted to a frame. The door is hinged at the bottom and swings downward and to the rear to an approximately horizontal position, where it is held by two door chains, attached to the handrail shanks, and to the door by door-chain fasteners.

The front plate and the door of the chest are strengthened by vertical corrugations pressed into the metal, those in the chest door serving as shields for the primers of the cartridges. The door is held in its closed position by two lock bars, each hinged in two lock-bar bearings riveted to the top of the chest. Door fastenings are similar to those on caisson.

Inside the chest the cartridges are supported by three vertical diaphragms, flanged all around and riveted to the body of the chest. Each diaphragm is perforated with 39 flanged holes. Between the diaphragms, riveted to them and supporting them, are 10 vertical plates called transoms, the lower ends of which are riveted to the middle and side rails.

The doubletree and singletrees are formed of flange steel. The hole in the former for the doubletree bolt is bushed with a bronze nipple held in place by a steel nut, and may be replaced when worn. Two doubletree rods reach from the ends of the doubletree to the tie-rod clamps on the axle to which they are pinned. The neck yoke is now made of steel sleeves and rings.

The pole is now made of steel and is prevented from turning in its seat by a pole pin. To the front end of the pole is riveted a pole plug and a neck-yoke stop. Just forward of the neck-yoke stop is the neck-yoke counterstop, which, with its spring, is hinged to the pole body and works through a slot cut in the under side of the pole. A pole prop is hinged to the rear end of the pole and when not in use it is secured by fastenings under the limber frame and the prop-chain button on the foot rest.

## THE 75-MM. GUN CAISSON, MODEL OF 1918.

## WEIGHTS, PRINCIPAL DIMENSIONS, ETC.

(PLATES XXIV AND XXV.)

Weight empty, without implements and ammunition	pounds.	.....
Weight of tools and equipment carried	do.	.....
Weight of ammunition carried	do.	.....
Weight, completely equipped and loaded	do.	.....
Weight with limber, completely equipped and with 106 rounds of ammunition	pounds.	4,525
Rounds of ammunition carried	number.	70
Diameter of wheels	inches.	56
Width of track, center to center of 3-inch tires	do.	60
Free height under caisson	do.	21
Turning angle	degrees.	81

*Nomenclature of parts.*

No.	Name of part.	Location, etc.	Property classification.	
			Class.	Section.
2	Wheels, 56-inch, complete, consisting of—		IV	8
16	Tire bolts, with nuts and washers.			
8	Dowels.			
64	Felloe rivets and washers.			
8	Felloe segments.			
16	Spokes, right.			
16	Spokes, left.			
2	Tires.			
2	Hub boxes.			
2	Hub liners.	Forced into hub boxes.		
2	Hub rings.	Outer flanges of hubs.		
16	Carriage bolts.	Bolt hub box and ring to spokes.		
16	Carriage-bolt nuts.			
2	Hub bands.	Screwed on hub boxes.		
2	Lock washers.	Between hub bands and hub rings.		
2	Hub caps.	On end of hubs.		
2	Hub latches with rivets.	Actuate hub-latch plungers.		
2	Hub-latch springs.			
2	Hub-latch plungers.	Lock hub caps in place.		
2	Oil valves.	Slide in hub caps.		
2	Washers (oil valve).			
2	Springs (oil valve).			
2	Wheel fastenings, consisting of—	At ends of axle.		
2	Wheel-fastening plungers.			
2	Wheel-fastening springs.			
2	Plugs.			
24	Intermediate spoke shoes.	Riveted to felloe.		
8	Joint spoke shoes.	do.		
32	Spoke-shoe plates.	Scale in spoke shoes.		
40	Spoke-shoe rivets.			

## Nomenclature of parts—Continued.

No.	Name of part.	Location, etc.	Property classification.	Class.	Section.
1	Axle.....	Full width of caisson.....			
2	Axle brackets.....	Bolted over axle.....			
4	Bolts with nuts and pins.....	For axle brackets.....			
	Brace lever shaft-bearing bolts.....				
	Middle rail, complete, consisting of.....				
1	Middle rail, left.....	Riveted to middle rail top plate.....			
1	Middle rail, right.....	do.....			
1	Middle rail top plate.....	Riveted to middle rail, left and right.....			
1	Middle rail transom.....	Riveted between middle rails, left and right.....			
2	Wheel guards with chain guide pins.....	Riveted to middle rails, left and right.....			
1	Tie-rod sleeve with bolt and washers.....	Bolted to middle rails, left and right.....			
2	End reinforcers.....	Riveted to middle rails, left and right.....			
1	Lunette bracket.....	Riveted to rear end of middle rail.....			
1	Lunette.....	Bolted to lunette bracket.....			
1	Lunette nut with lock washer.....	On end of lunette.....			
1	Caisson prop, complete, consisting of—	On front end of side rails.....			
1	Prop eye, right.....	Riveted to right tube.....			
1	Prop eye, left.....	Riveted to left tube.....			
2	Prop tubes.....	Supports pole.....			
1	Prop foot.....	Riveted to lower ends of tubes.....			
1	Fastening pin.....	Through prop eyes.....			
2	Prop-chain clamps.....	On prop tubes.....			
2	Prop chains.....	Secured to prop.....			
1	Prop hook.....	On chain.....			
1	Prop-chain button with guide.....	Riveted to middle rail top plate.....			
5	Prop-chain guides.....	Riveted to middle rail, sides.....			
1	Frame handle, left.....	Riveted to middle rail, left.....			
1	Frame handle, right.....	Riveted to middle rail, right.....			
1	Name plate.....	Riveted to middle rail, top.....			
1	Shovel-blade bracket.....	Riveted to middle rail, side, below.....			
1	Tie rod, right.....	Bolted to middle rail and axle bracket, right.....			
1	Tie rod, left.....	Bolted to middle rail and axle bracket, left.....			
2	Tie-rod bolts.....	Bolt tie rods to axle bracket.....			
1	Fuze-setter bracket lug, inner.....	Riveted to middle rail, right.....			
1	Pintle with bearing, complete, consisting of—				
1	Pintle.....	Seated in pintle bearing.....			
1	Pintle latch.....	On pintle.....			
1	Pintle-latch pin, with split pin.....	Forms pivot of latch.....			
1	Pintle-latch spring.....	On pintle.....			
1	Pintle bearing.....	Rear end of middle rail.....			
1	Pintle spring.....	In pintle bearing.....			
1	Pintle-spring pin.....	do.....			
2	Pintle-bearing bolts with nuts and washers.....	Secures bearing to middle rail.....			
1	Pintle-spring seat.....	In pintle bearing.....			

## Nomenclature of parts—Continued.

No.	Name of part.	Location, etc.	Property classification.	
			Class.	Section.
1	Spring plunger.....	In pintle.....		
1	Apron hinge lug, center.....	Riveted to middle rail.....		
	Side rails, complete, consisting of—			
1	Side rail, left.....	Riveted to chest-rest on springs.....		
1	Side rail, right.....	do.....		
4	Side rail liners, left.....	Riveted to inside side rails.....		
4	Side rail liners, right.....	do.....		
4	Spring bolts with nuts and pins.....	Bolted to side rails and through axle bracket.....		
4	Carrying springs.....	Assembled around spring bolts above axle.....		
16	Belleville springs.....	Assembled around spring bolts below axle.....		
	Ammunition chest, complete, consisting of—			
2	Intermediate bottom plates.....	Riveted to middle and side rails.....		
2	Outer bottom plates.....	Riveted to side rails.....		
1	Chest angle.....	Framing for back of chest.....		
1	Chest back.....	Back of chest.....		
1	Top plate.....	Forms top and sides of chest.....		
1	Door angle.....	Framing for chest door.....		
1	Door.....	Hinged to top.....		
1	Front diaphragm.....	Riveted inside chest.....		
1	Middle diaphragm.....	do.....		
2	Diaphragm reinforces.....	do.....		
1	Rear diaphragm.....	do.....		
2	Diaphragm reinforces.....	do.....		
2	Front transoms, right.....	do.....		
2	Front transoms, left.....	do.....		
2	Middle transoms, right.....	do.....		
2	Middle transoms, left.....	do.....		
2	Rear transoms, right.....	do.....		
2	Rear transoms, left.....	do.....		
70	Ammunition chest connecting pieces.....	Braided on front and middle diaphragms.....		
140	Reinforce pieces.....	Braided on corner piece.....		
4	Hinge reinforce.....	Riveted on top of chest.....		
4	Door hinge, male.....	Riveted to chest door.....		
4	Door hinge, female.....	Riveted to chest top.....		
4	Door-hinge pins.....	In hinges.....		
7	Door tees.....	Riveted on door.....		
1	Door-handle bar.....	do.....		
2	Door-handle bases.....	do.....		
2	Lock bars.....	In lock-bar hinges.....		
4	Lock-bar hinges.....	Riveted on door.....		
4	Lock-bar stops.....	Riveted on foot rest.....		
2	Wing nuts.....	On wing-nut pins.....		
2	Wing-nut pins.....	Riveted to door.....		
2	Wing-nut pin reinforced.....	Riveted to chest door.....		
2	Wing-nut pin washers.....	On pin.....		
2	Chains with bolt snaps, rings, and rivets.....	Riveted to door.....		
1	Door prop.....	Bolted to door-prop stud and sliding mat.....		
1	Door-prop stud.....	Riveted to door.....		
1	Door-prop guide.....	Bolted to side of chest.....		
1	Door-prop sliding rivet with washer.....	Fits in guide riveted to prop.....		



## Nomenclature of parts—Continued.

No.	Name of part.	Location, etc.	Property classification.	
			Class.	Section.
1	Wrench holder.....	Riveted to side of chest.....		
1	do.....	do.....		
1	do.....	do.....		
1	do.....	do.....		
1	Pick-mattock head bracket.....	Riveted to chest door.....		
1	Pick-mattock handle support.....	do.....		
1	Pick-mattock point guard.....	do.....		
1	Pick-mattock guard.....	do.....		
1	Ax guard.....	do.....		
1	Ax-handle support.....	do.....		
1	Ax-handle bracket.....	do.....		
13	Strap fasteners.....	Riveted to chest.....		
11	do.....	do.....		
1	Padlock.....			
4	Handrail shanks with rivets and washers.....	Riveted to sides of chest.....		
2	Handrails.....	Fit in shanks.....		
1	Foot rest.....	Stayed to chest.....		
2	Foot-rest reinforce, 1 left, 1 right.....	Riveted to foot rest at front.....		
1	Foot-rest corner brace.....	Riveted to foot rest and chest.....		
1	Foot-rest brace, left.....	do.....		
1	Foot-rest brace, right.....	do.....		
1	Receptacle body.....	Riveted to chest by brackets.....		
1	Receptacle top body.....	Riveted to top of body and chest.....		
2	Receptacle adjusters, large.....	Attached to body, inside.....		
2	Receptacle adjusters, small.....	do.....		
4	Receptacle adjuster screws with wing nuts.....	Attached to adjusters.....		
1	Receptacle reinforcement, left.....	Riveted to bottom of body.....	IV	3
1	Receptacle reinforcement, right.....	do.....		
2	Receptacle intermediate bracket.....	Riveted to chest and body.....		
1	Receptacle center bracket.....	do.....		
1	Receptacle end bracket, right.....	do.....		
1	Receptacle end bracket, left.....	do.....		
1	Apron, complete, consisting of—			
1	Apron.....	Hinged to.....		
4	Apron hinges.....	Pinned to hinges.....		
1	Apron-hinge lug center.....	(See middle rail).....		
2	Apron-hinge lug ends.....	Bolt on spring rod.....		
1	Apron-latch base, left.....	Riveted to foot rest.....		
1	Apron-latch base, right.....	do.....		
4	Apron-latch base reinforces.....	Welded to latch base.....		
2	Apron latch staples.....	Riveted to apron.....		
4	Latch bodies.....	Pinned to latch bases (for apron and fuse-setter latches).....		
4	Latch handles.....	In latch bodies (for apron and fuse-setter latches).....		
4	Latch springs.....	do.....		
4	Latch plungers.....	do.....		
2	Brakes, complete, consisting of—			
2	Brake drums.....	Bolted to wheels.....		
8	Lock washers.....	For brake-drum bolts.....		
1	Brake hanger, left.....	For brake over axle.....		
1	Brake hanger, right.....	do.....		
2	Brake hanger bolts.....	do.....		
2	Handy oilers.....	For brake hangers.....		
4	Band clips.....	Riveted to hangers.....		
4	Band guides.....	Riveted to band clips.....		

## Nomenclature of parts—Continued.

No.	Name of part.	Location, etc.	Property classification.
			Class. Section.
	<b>Brakes, complete, consisting of—</b>		
	Continued.		
2	Brake-band bodies.....	Over drum.....	
2	Brake-band linings.....	Riveted inside brake-band bodies.	
4	Brake-band ends.....	Riveted to brake-band bodies.	
2	Adjusting nuts with pins.....	Pinned to brake-band ends....	
2	Adjusting links with pins.....	Pinned to brake lever-shaft; screwed into adjusting nut.	
2	Cranks, outer.....	Keyed to brake shaft.....	
2	Brake rods with pins.....	Screwed into brake-rod ends..	
		Pinned to brake-rod and crank, outer.	
1	Brake-rod ends.....	Pinned to brake-rod and brake crank.	
2	Brake shafts.....	Bear in hangers.....	
1	Brake lever-shaft bearing....	Riveted to chest and foot rest.	
1	Bushing.....	For above bearing.....	
1	Brake lever shaft.....	Bears in above bearing and crank shaft.	
1	Brake crank.....	Pinned to brake rod; keyed to crank shaft.	
1	Brake-crank shaft bearing, right.	Riveted to chest.....	
1	Brake-crank shaft bearing, left.	.....do.....	
1	Brake-crank shaft.....	Bears in shaft bearing.....	
1	Brake lever.....	Keyed to lever shaft.....	
1	Brake-lever latch.....	Riveted to lever.....	
1	Segment rack.....	Riveted to chest and foot rest.	
1	Segment guard.....	Riveted to segment.....	
1	Separator.....	Spaces segment rack from chest.	IV 3
	<b>Fuse-setter bracket, consisting of—</b>		
2	Fuse-setter anchor-rod bearings.	Riveted to bracket arms.....	
1	Fuse-setter latch base, right..	Riveted to ammunition chest.	
1	Fuse-setter latch base, left..	.....do.....	
3	Fuse-setter latch-base stiffeners.	.....do.....	
1	Fuse-setter stop.....		
1	Fuse-setter anchor rod.....	In anchor-rod bearings.....	
2	Fuse-setter bracket latch staple with nuts.	Bolted to bracket arms.....	
1	Fuse-setter bracket lug, outer.	Riveted to side rail.....	
1	Fuse-setter bracket lug, inner.	Riveted to middle rail.....	
1	Fuse-setter bracket end, left.	Riveted to bracket arm.....	
1	Fuse-setter bracket end, right.	.....do.....	
1	Fuse-setter carrier.....	Riveted between bracket arms.	
1	Fuse-setter bracket arm, left.	Pinned to middle rail by lugs.	
1	Fuse-setter bracket arm, right.	Pinned to side rail by lugs....	
1	Fuse-setter bracket separator.	Riveted between bracket arms.	
1	Fuse-setter anchor.....	Bears on anchor rod.....	
1	Fuse-setter anchor bracket....	Riveted to bracket arms.....	
1	Fuse-setter filler.....	Riveted to anchor-rod bracket.	
1	Fuse-setter bracket stop.....	Riveted to anchor bracket.....	

IV

3

## DESCRIPTION OF THE 75 MM. GUN CAISSON, MODEL OF 1918.

(PLATES XXIV and XXV.)

The caisson is made of metal throughout, with the exception of the felloes and spokes of the wheels. The principal parts of the caisson are the wheels, axle, frame, brake, and ammunition chest.

The wheels and wheel fastenings are interchangeable with those of the other vehicles in the battery except carriage and limber. The axle is of hollow steel, made in one piece.

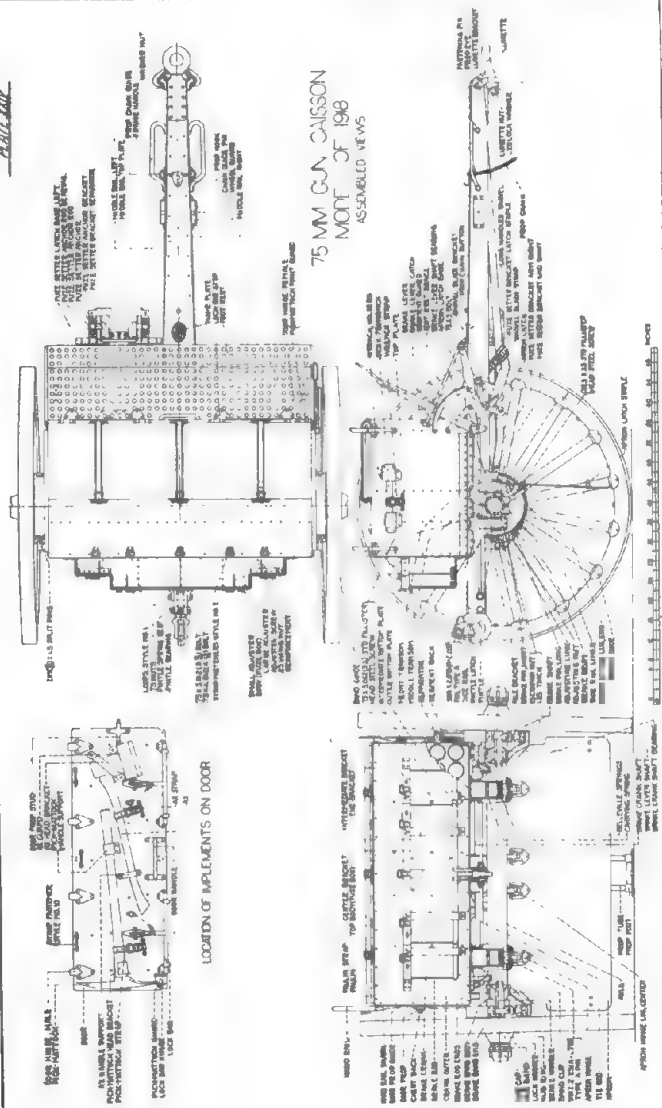
The wheels are a modified form of the Archibald pattern, 56 inches in diameter, with 3-inch tires. The hub consists of a forged-steel hub box and hub ring assembled with eight carriage bolts through the flanges and with a bronze hub cap screwed on the outer end of the hub box. The hub band is screwed on the hub box. A lock washer is placed between the hub ring and the hub band, preventing the latter from unscrewing. The bronze hub cap is screwed on the hub box and is locked with the hub-latch plunger, which is withdrawn and held in the disengaged position by the hub latch when the hub cap is to be unscrewed. Assembled to the hub cap and projecting into the axle arm is an oil valve, through which the wheel is oiled without removal. The hub box is fitted with a bronze liner, forced into place. The liners are removable. The tire is shrunk on and secured to the felloe by eight tire bolts.

The wheel fastening consists of a bronze yoke fitting in the outer end of the axle arm and is accessible when the hub cap is removed.

The frame consists principally of two side rails and a middle rail, braced by two tie-rods and also by the ammunition chest, to which they are riveted and of which they form a part of the bottom. The tie-rods are bolted to the middle rail and to the side rails near the axle. The middle rail is made of two pressed steel channels connected by a top cover plate, with the flanges overlapping in the rear to form a pintle seat, the front ends being riveted to a lunette bracket. In the latter a lunette is assembled by a lunette nut.

The side rails are of cast steel, the length of the chest. Each has two pairs of vertical guides that straddle the axle, fitted with bronze liners in which the axle bracket slides. Above and between these liners the side rail is bored out and tapped for the spring rod and counterbored for the caisson carrying spring. Clamped to the axle at each side rail is an axle bracket, upon which are formed two lugs bored out for the spring rod and counterbored for the caisson carrying spring. These lugs slide up and down between the side rail liners and hold the chest from lateral and longitudinal motion with respect to the axle. The four caisson carrying springs, assembled

**PLATE 107**



upon spring rods, are compressed between these lugs and the side rail, thus supporting the chest on the axle and allowing it 0.75 inch of movement. The upper end of each spring rod is screwed into the threaded portion of the side rail; the lower end extends below the axle bracket lugs, where there are assembled upon it four Belleville springs, held in place by a nut on the lower end of the rod. When the caisson is traveling over rough road the rebound of the chest from the caisson carrying springs is met by the action of the Belleville springs, which are compressed between the spring rod nuts and the axle bracket lugs.

The nuts on the two front spring rods serve as apron hinge lugs. To these two lugs are pinned the end apron hinges. An apron hinge lug, center, made of flange steel and riveted to the middle rail, supports the remaining two of the four hinges by which the apron is hung.

The apron is made of armor plate and extends to within 4.5 inches of the ground when lowered.

For traveling the apron is drawn up to the front and held by two apron latches.

Each apron latch consists principally of a latch body, handle, plunger, and spring. The apron latch body is pinned to an apron latch base riveted to the side of the foot rest; the lower end of the latch body terminates in a hook, which engages an apron latch staple riveted to the apron and holds the latter in traveling position. To retain the staple in the hook, the opening of the hook is closed by a plunger seated in the latch body and pressed outward into action by a coiled spring. By pressing the apron latch handle down with the hand, the plunger is first withdrawn from the hook, and then the hook is pushed backward, disengaging it from the apron latch staple.

The pintle bearing is of bronze, bored out to take the pintle shank, and is held in place by two bolts through the middle rail. The pintle has a swiveling motion of  $360^{\circ}$  upon its shank, but is kept in its normal position by the pintle spring in the pintle bearing, which presses a spring plunger against a flattened seat on the shank. The lunette of the drawn vehicle is retained upon the pintle hook by a pintle latch, which is pivoted by a pin upon the end of the pintle horn and is held in either the open or the closed position by the pintle-latch spring. The latch is opened by the entering lunette, but must be closed by hand. The spring is peened in its seat, but may readily be driven out and a new one inserted, if desired.

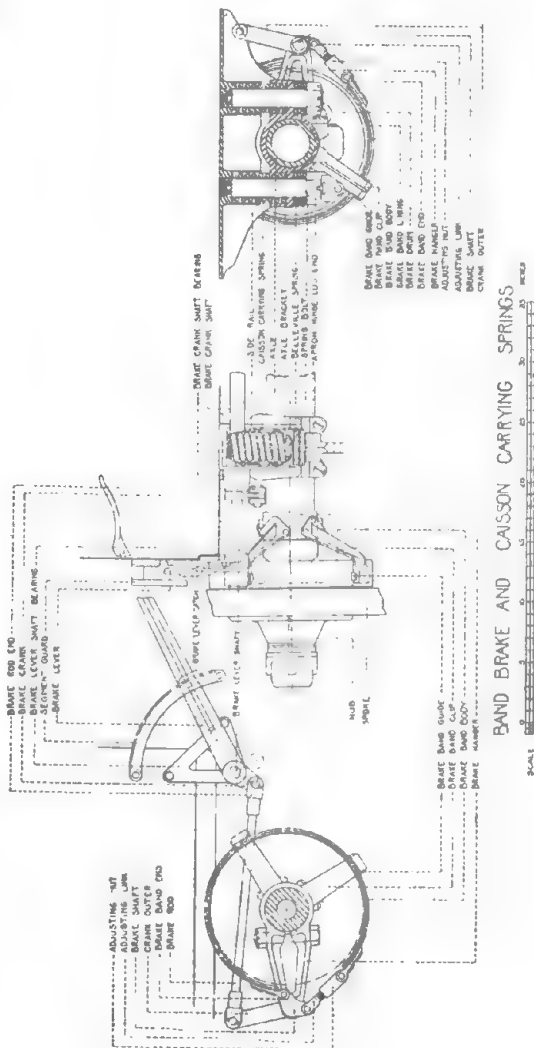
Near the front end of the middle rail and riveted thereto are two frame handles and two wheel guards. Between the wheel guards,

inside the middle rail, which it braces, is a stiffener called a middle-rail transom. A caisson prop, formed of two steel tubes united by a bronze foot, is hinged on a prop pin which passes through the middle rail and lunette bracket. When not in use, the prop is swung up against the middle rail and is held in that position by chains leading from the prop legs through guides on the middle rail, and uniting in a hook, which is engaged over a button riveted to the middle-rail top cover plate.

The standard form of drum brake is used as illustrated on Plate XXV. There are two brake drums, one on each wheel and one hand lever on the right-hand side of the caisson seat, which is operated from the seat. Cast-iron brake drums are bolted to the wheels and revolve with them. Brake bands lined with Raybestos are assembled around the drums and held in place by lugs riveted to drums. Lateral movement of the lugs is prevented by brake-band clips consisting of brackets riveted to brake hangers which fit over the lugs on bands. Brake hangers are bolted fast over axles. Brake bands are provided with forked ends, the lower end having adjusting nut pinned to it, and the upper end being pinned to a lever arm on brake lever. The adjusting nut has an adjusting link threaded into it, and the link is pinned to the other arm of the brake lever.

Brake shaft is a short shaft with two short arms at the outside end and the inside end squared to take the outer crank, which is attached to the inner end of this shaft and pinned to brake rod. The brake rod has an adjusting nut at each end and is pinned to the brake crank. Brake crank on the right side is integral with brake crank shaft and on the left side is keyed to the brake crank shaft. The brake crank shaft is held in bearings at the front of the seat and consists of a hollow rod with a squared hole in the center into which the brake shaft fits. The brake lever is keyed to the end of the brake-lever shaft and provided with a catch which engages with segment bracket pinned to chest. When the brake lever is pulled back the brake lever shaft turns in a counter clockwise direction, and being fixed to brake crank shaft causes crank shaft to turn with it. This motion is transmitted through the brake crank, brake rod, outer crank, and brake shaft to the upper brake band end and the adjusting link, and through the latter by means of adjusting nut to the lower brake band end, tightening the brake band about the drum.

The caisson ammunition chest is a rectangular steel box built up of flange steel, with provision for 70 rounds of ammunition arranged in 5 horizontal rows of 14 rounds each. The top and sides of the chest are one piece of flange steel, and the bottom is made up of four pieces, called outer bottom plates and intermediate bottom



plates. The back of the chest is made of armor plate 0.15 inch thick. A steel angle is riveted to the armor plate all around its edge, and the projecting leg of the angle is riveted to the body of the chest.

Inside the chest the cartridges are supported by three vertical diaphragms, flanged all around and riveted to the body of the chest. Corresponding holes in the front and middle diaphragms are connected by cylindrical brass pieces. The diaphragms are rigidly braced to each other and to the caisson frame by 12 transoms riveted to the diaphragms, the middle and side rails, and also to the chest back, which they serve to stiffen. Riveted to the bottom of the rear and middle diaphragms and to the top of the side rails are four diaphragm reinforces made of flange steel angle, which help to transmit the load from the diaphragms to the side rails.

The chest door is made of armor plate 0.15 inch thick. It is hinged to the body of the chest at the top by four hinges, at each of which, inside the chest, is a hinge reinforce riveted to the chest top and middle and front diaphragms. The door is held closed by two lock bars hinged to the bottom of the door. A hasp and two eccentric lugs are formed upon each of these bars; in locking the door these lugs bear against an equal number of lock bar stops riveted to the foot rest, thus pressing the door shut, while the hasp engages a wing nut higher up on the door. The right lock bar may be locked in position either by a spring padlock or a bolt snap, both of which are fastened by a chain to the door near the wing nut and engage in the eye of the latter; the left lock bar has only the bolt snap so attached.

Seven steel tees are riveted to the inner face of the door. These tees are spaced so that with the door closed the vertical leg of a T falls between each alternate row of cartridges, and the horizontal legs press against the heads of the cartridges. The rims of the cartridge cases are thus firmly held between the front diaphragm and the door tees, which, in addition to forming stiffeners for the door, provide clearances between the doorplate and the cartridge percussion cap, for the protection of the latter. The lower edge of the door is also stiffened by a steel angle running its entire length.

The door opens upward and forward, swinging through an arc of 120° to its open position, where it is held by a door prop on the left side of the chest. One end of the prop is secured with a nut on a door-prop stud riveted to the door; the other end runs in a door-prop guide riveted to the side of the chest. As the door is thrown open, the props catch in notches in the guides and hold it in the open position; to close the door the props must be released by hand



from the guide notches. A door handle is riveted in the middle of the door at its lower edge.

The top of the chest forms a seat for cannoneers and has a hand-rail at each side. To one set of strap fasteners riveted to the door are attached three grip straps for the use of the cannoneers; and to another set riveted to the top of the chest are attached three paulin straps for securing the paulin, which serves as a seat cushion. In front of the chest is provided a foot rest, a perforated sheet metal plate the width of the chest, formed to shape and riveted on; it is supported by the middle rail and by a foot-rest brace at each side riveted to the sides of the chest. The rear corners are strengthened, on the right side by the brake lever shaft bearing, and on the left side by a foot rest corner brace, which is riveted to the side of the foot rest and to the chest.

The fuze-setter bracket consists of two angle irons united in the front to a bronze fuze-setter bracket separator, forming a seat, to which the fuze setter is bolted. In the rear the angles are hinged to brackets—one outer, which is riveted to the side rail, and one inner, which is riveted to the middle rail. A fuze setter latch, pinned to a fuze-setter latch base, which latter is riveted to the front of the foot rest, engages a pin in the bronze separator mentioned above, and thus holds the bracket with fuze setter in traveling position. For use the fuze setter with bracket is released from the latch and swung down and supported by a jointed rod extending from the separator to the fuze-setter latch base. This jointed rod consists of an upper and a lower rod pinned together, and also pinned at both ends, the flexibility of the connection allowing the rod to fold up when the bracket is swung up for traveling.

The fuze-setter latch is the same as, and the parts are interchangeable with, the apron latch described above, with the exception of the handle, which, on the fuze setter latch, is designed as a finger hold to be lifted in releasing. This arrangement obviates the possibility of dropping down the fuze setter by accident.

A long-handled shovel is carried under the middle rail, the end of the handle resting in the lunette bracket, while the blade rests in a bracket riveted to the sides of the middle rail under the foot rest. The shovel is secured in position by a leather strap. On the back of the chest are carried an ax, resting in an ax-head bracket and an ax-handle support; a pick mattock, resting in a pick-mattock head bracket and an ax-handle support, the handle being prevented from coming out of the head by a pick-mattock handle stop, riveted to the side of the chest; and a spanner and a wrench, each

carried in two wrench holders. These brackets are all riveted to the chest back, and all the implements are secured by leather straps.

A name plate is attached to each caisson on the middle-rail top cover plate just in front of the foot rest, which gives the number, name of caisson, model, name of manufacturer, year of completion, and initials of inspector.

*In all reports and correspondence the caisson should be designated by the number, name, model, etc., given on this name plate. In requests for spare parts for repairs, etc., the parts should be asked for by the names given on the plates or in the paragraph giving nomenclature of parts in this handbook.*

### FORGE LIMBER, MODEL OF 1902 M1.

#### WEIGHTS, DIMENSIONS, ETC.

(PLATE XXVI)

Weight, empty, without equipment.....	pounds..	958
Weight, complete, equipped and loaded.....	do	1,577
Weight of forge limber and battery wagon, both complete, equipped and loaded.....	pounds..	4,324 *
Diameter of wheels.....	inches..	56
Width of track.....	do	60
Free height under limber.....	do	26 5
Turning angle with battery wagon.....	degrees	75

#### *Nomenclature of parts.*

No.	Name of part.	Location, etc.	Property classification.	
			Class.	Section.
2	Wheels and wheel fastenings.....	Same as on caisson.....		
1	Axle.....			
1	Middle rail (upper and lower half), consisting of—	Riveted to axle.....		
1	Pole clamp.....	Riveted to middle rail.....		
1	Pole-prop bracket.....	Riveted to pole clamp and middle rail with limber prop in place.....		
1	Pole clamp bolt.....	In pole clamp.....		
1	Pole clamp nut.....			
1	Pole pin with bushing.....	Secures pole in seat.....	VI	3
1	Pole-pin reinforce.....	Riveted to lower half of middle rail.....		
1	Pole stop.....	Riveted between upper and lower half of middle rail.....		
2	Separating pieces.....	Riveted to middle rail with side rails.....		
1	Doubletree strap.....	Riveted to middle rail.....		
1	Doubletree bolt.....	In bolt clamp and doubletree strap.....		
1	Doubletree nut.....			

## Nomenclature of parts—Continued.

No.	Name of part.	Location, etc.	Property classifi- cation.	Class. Section.
2	Side rail, right, consisting of.....	Riveted to axle and middle rail		
1	Reinforce plate, front.....	Riveted to side rail.....		
1	Reinforce plates, rear.....	do.....		
1	Sleeves.....	do.....		
1	Step.....	do.....		
1	Pole-prop packet.....	do.....		
1	Side rail, left, consisting of.....	Riveted to axle and middle rail		
1	Reinforce plate, front.....	Riveted to side rail.....		
1	Reinforce plates, rear.....	do.....		
1	Sleeves.....	do.....		
1	Step.....	do.....		
1	Pole-prop support.....	do.....		
1	Strap fastener.....	Riveted to side rail, for pole-prop strap.		
1	Name plate.....	Riveted to middle rail.....		
1	Lumber prop, consisting of.....	Assembled to middle rail by means of pole-clamp eye.		
1	Lumber-prop foot.....	Pinned to bottom of prop.....		
1	Lumber-prop eye.....	Pinned to top of prop.....		
1	Chain.....	Secured to prop foot.....		
1	Prop tube.....	Hinged to pole by prop eye.....		
1	Prop-chain fastener.....	Riveted to chain.....		
1	Prop-chain handle.....	Riveted to prop tube.....		
1	Prop-chain handle.....	End of prop chain.....		
1	Prop carrier, right.....	Riveted to frame.....		
1	Prop carrier, left.....	do.....		
1	Tie-rod, rear, right.....	Brace middle rail from axle.....		
1	Tie-rod, rear, left.....	do.....		
2	Tie-rods, front.....	do.....		
1	Tie-rod clamp, right.....	On axle arms.....		
1	Tie-rod clamp, left.....	do.....		
6	Tie-rod pins.....	Fasten ends of tie rods.....		
2	Double-tree-rod pins.....	Secure rods to tie-rod clamps.....		
1	Foot rest, consisting of.....			
1	Angle piece, right.....	Riveted to foot rest.....		
1	Angle piece, left.....	do.....		
2	Foot-rest liners.....	do.....		
1	Pick-handle rest, large end.....	do.....		
1	Pick-handle rest, small end.....	do.....		
1	Pick pocket, needle end.....	do.....		
1	Pick-head lower strap fastener.....	do.....		
1	Prop-chain button.....	do.....		
1	Prop-chain rivet.....	do.....		
1	Ax-handle bracket.....	do.....		
1	Strap fastener for shovel handle.....	do.....		
1	Pintle with bearing, complete, consisting of—			
1	Pintle.....	Seated in pintle bearing.....		
1	Pintle latch.....	On pintle.....		
1	Pintle-latch pin with split pin.....	Forms pivot of latch.....		
1	Pintle-latch spring.....	On pintle.....		

## Nomenclature of parts—Continued.

No.	Name of part.	Location, etc.	Property classifi- cation	Class. Section.
	Pintle with bearing, complete, consisting of—Continued.			
1	Pintle bearing (in two parts).	Rear end of middle rail.		
1	Pintle-bearing spring.	In pintle bearing.		
2	Pintle-bearing bolts with nuts.	Secure bearings to middle rail.		
1	Pintle-bearing guide.	Around pintle-bearing spring.		
1	Pole supporting spring.	Assembled around rod.		
1	Spring rod.	Bolted to guide.		
1	Spring-rod nut.	On spring rod.		
1	Spring-rod pin.	Pin rod to guide.		
1	Doubletree, consisting of.	On doubletree bolt.		
1	Doubletree body with reinforcement.			
10	Separators.	Riveted together.		
1	Nipple separator.			
1	Double hook, right.			
1	Double hook, left.			
1	Double-tree nipple.	Renewable.	IV	3
1	Nipple nut.			
	Pole, complete, consisting of—			
1	Pole body.			
1	Pole plug.	Riveted in body.		
1	Neck-yoke counter stop spring.	Bears on neck-yoke counter stop.		
1	Neck-yoke counter stop-spring pin.	Riveted in body.		
1	Neck-yoke counter stop.	Hinges on counter-stop pin.		
1	Neck-yoke stop.	Riveted to body.		
1	Neck-yoke chafing plate.	Riveted to upper side of body.		
1	Pole-pin bushing.	Inside of body.		
1	Butt reinforce.	Riveted to inside of body.		
1	Shovel-handle bracket.	Riveted to foot rest and middle rail.		
1	Shovel-blade bracket.	Riveted to foot middle rail.		
1	Forge limber chest, complete, consisting of—			
1	Back and left end.	Part of body.		
1	Front and right end.	do.		
1	Bottom.	do.		
1	Lid.	Hinged to body.		
1	Lid stiffener.	On lid.		
4	Chest-rail filler pieces.	Riveted to body and chest rail.		
1	Outer left-hand partition.	Part of body.		
1	Inner left-hand partition.	do.	IV	8
1	Inner right-hand partition.	do.		
1	Outer right-hand partition.	do.		
1	Longitudinal partition, right.	do.		
1	Longitudinal partition, left.	do.		
1	Left rear corner angle.	do.		
1	Right front corner angle.	do.		
2	Bottom stiffening angles.	do.		
2	Corner tie pieces.	do.		
2	Filler pieces.	Part of body under handrail brackets.		

## Nomenclature of parts -Continued.

No.	Name of part.	Location, etc.	Property classifi- cation.
Class.	Sec- tion.		
<b>Forge limber chest, complete,</b>			
consisting of Continued.			
2	Shot-bolt stops.....	Riveted to body.....	IV
1	Shot-bolt bracket, right.....	do.....	
1	Shot-bolt bracket, left.....	do.....	
2	Shot-bolt filler pieces.....	do.....	
1	Hasp.....	do.....	
1	Hasp hinge.....	Riveted to lid.....	
1	Hasp-hinge pin.....	In hinge.....	
1	Padlock-chain rivet.....	Riveted to body.....	
1	Chest rail, right.....	do.....	
1	Chest rail, left.....	do.....	
4	Chest-rail connection.....	Riveted to chest.....	
1	Shot bolt, right.....	In brackets on chest body.....	
1	Shot bolt, left.....	do.....	
1	Shot-bolt hasp, right.....	Rivets lid to lid.....	
1	Shot-bolt hasp, left.....	do.....	
1	Wing-nut pin.....	Riveted to chest body.....	
1	Wing nut.....	Riveted on pin.....	
1	Wing-nut pin washer.....	On pin.....	
1	Wing-nut pin washer, large.....	Between pin and chest body.....	
1	Padlock, with chain and bolt snap.....	Eye rivet on chest body.....	
4	Lid hinges.....	Riveted to lid and body.....	
4	Lid-hinge pins.....	do.....	
4	Handrail brackets.....	Riveted to body of chest.....	
2	Handrail tubes.....	Connect handrail brackets.....	
1	Bucket holder.....	Riveted to top of chest.....	
1	Lantern-bracket body.....	Riveted to body.....	
1	Lantern-bracket bottom.....	do.....	
2	Lantern-strap fastening.....	do.....	
1	Lid-prop bracket.....	Riveted to lid.....	
1	Lid-prop guide, left.....	Riveted to chest partition.....	
1	Lid prop.....	Riveted on lid-prop bracket.....	
1	Lid-prop rivet.....	Rivets lid prop to bracket.....	
1	Lid-prop sliding rivet.....	Riveted to lid prop.....	
1	Hatchet-blade bracket.....	Riveted to side of chest.....	
1	Hatchet-handle fastening.....	do.....	
1	Ratchet-drill fastening, No. 1.....	Riveted to outer right-hand partition.....	
1	Ratchet-drill fastening, No. 2.....	Riveted to inside of chest back.....	
1	Forge-legs fastening, No. 1.....	Riveted to inner right-hand partition.....	
1	Forge-legs fastening, No. 2.....	do.....	
1	Screw-wrench fastening, No. 1.....	Riveted to outer right-hand partition.....	
1	Screw-wrench fastening, No. 2.....	do.....	
1	Chisel (cold iron) fastening.....	Riveted to inside of right end.....	
1	Chisel (hot iron) fastening.....	do.....	
1	Flatter fastening.....	do.....	
1	Hand-hammer fastening.....	Riveted to outer right-hand partition.....	
2	Fore punch and creaser fastenings.....	Riveted to inside of left end.....	
1	Shoeing-rasp fastening, No. 1.....	Riveted to inner right-hand partition.....	
1	Shoeing-rasp fastening, No. 2.....	do.....	

*Nomenclature of parts—Continued.*

No.	Name of part.	Location, etc.	Property classification.	
			Class.	Section.
	Forge limber chest, complete, consisting of—Continued.			
1	Flat bastard file fastening	Riveted to inner left-hand partition		
1	Taps and dies fastening, No. 1	Riveted to inside of back of chest near left end.		
1	Taps and dies fastening, No. 2	Riveted to inside of front of chest near left end.		
1	Square fastening, No. 1....	Riveted to underside of lid near center, front.		
1	Square fastening, No. 2.....	Riveted to underside of lid near center, rear.		
1	Square fastening, No. 3.....	Riveted to underside of lid near right end, rear.		
1	Pincer and nipper handle fastening.	Riveted in chest.....		
1	Pincer and nipper jaw fastening.	.....do.....		
1	Riveting hammer fastening.	Riveted to outer right-hand partition		
1	Rivet-set packing strap.....	In chest.....		
1	Shoosing-hammer fastening...	Riveted to outer right-hand partition.	IV	9
1	Clinching-iron fastening.....	.....do.....		
1	Hardie fastening.....	Riveted to inside of right end		
1	Oiler fastening.....	Screwed to anvil block		
3	Portable forge fastening.....	Riveted to underside of lid....		
1	Forge gear wheel fastening, No. 1	Riveted to inner left hand partition.		
1	Forge gear wheel fastening, No. 2.	Riveted to lid-prop bracket and lid.		
2	Anvil fastenings.....	Riveted to lid.....		
1	Sledge-handle bracket.....	Riveted to bottom of chest....		
1	Ax-head bracket.....	.....do.....		
2	Front oil-can supports.....	.....do.....		
2	Middle oil-can supports.....	.....do.....		
2	Rear oil-can supports.....	.....do.....		
2	Oil-can support covers.....	Hinged to rear oil-can supports		
2	Sash cord.....	Fastened to oil-can support cover.....		
2	Oil-can support latches.....	On covers.....		

## DESCRIPTION OF FORGE LIMBER, MODEL OF 1902-M1.

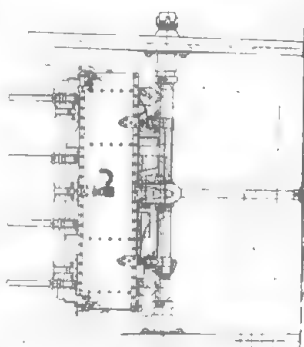
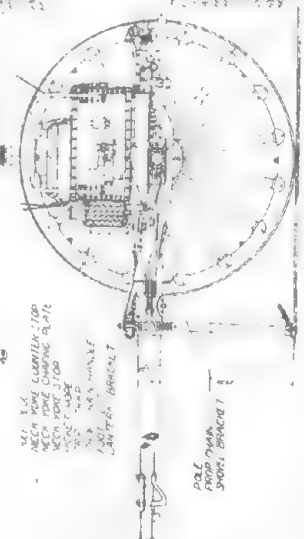
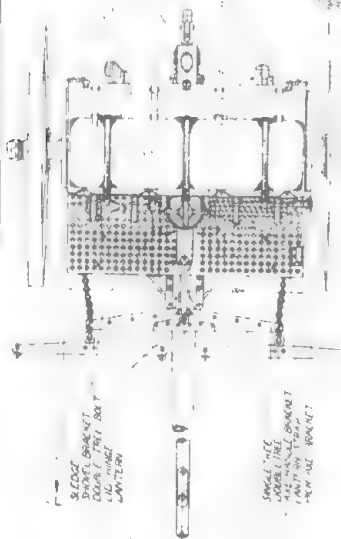
## PLATE XXVI.

The forge limber model of 1902 M1 differs from the 75-mm. caisson limber model of 1918 only in the construction of the chest and foot rest, which are fitted to carry the tools and supplies pertaining to a farrier's shop, with the addition of some machinists' tools. The limber frame in all its parts is the same as the caisson limber, and the chest is attached to the frame in a similar manner.

The forge-limber chest is a rectangular flange-steel box with chest lid on top. The lid is flanged all around, fitting over the body of the chest to make it water-tight. It is secured in front to the body of the chest by four hinges, and in rear it is held in its closed position by a shot bolt at each corner and by a hasp and wing nut in the middle. The shot bolts are seated in brackets riveted to the chest, while the shot-bolt eyes are riveted to the lid; the hasp is hinged to a hasp hinge plate riveted to the lid, and the wing nut is attached to the wing-nut pin, riveted to the body of the chest. A spring padlock, fastened by chain and staple to the chest, may be passed through the eye of the wing nut to lock the chest lid when closed. Outside on top is a raised seat, fastened to the chest lid, with spaces underneath for carrying three watering buckets. The seat has a handrail at each end riveted to the chest body. Various strap fasteners for paulin straps, grip straps, picket-rope straps, etc. and brackets for carrying all the implements carried on other limbers are provided. Arrangements are also provided for carrying on each forge-limber chest one sledge and two oil cans. The sledge rests in a sledge holder riveted on the right end of the foot rest, with the handle projecting to the rear through a sledge-handle bracket riveted to the bottom of the chest. The oil cans are carried one under each end of the chest. For this purpose, for each can three flange-steel brackets, called the front, middle, and rear oil-can supports, are riveted to the bottom of the chest. The can is placed in the supports from the rear and is retained in place by a bronze cover on the rear bracket. This cover is hinged at the bottom and held in close position by a spring latch. If desired, the latch may be more firmly secured in locking position by a split pin.

The inside of the chest is divided (into five compartments) by four vertical partitions reaching from front to rear. The end compartments are comparatively narrow and are fitted with fastenings for carrying smith's and machinist's tools, each so that it can be taken out without removing any other. The compartments next to the tool compartments are wider and are subdivided by lateral partitions forming two compartments for horseshoes and two for horseshoe nails, with a total capacity for 300 pounds of horseshoes and 50 pounds of nails. The horseshoes are carried loose in the compartment, which is wood lined; the horseshoe nails may also be carried loose, though the nail compartments are made of the proper size to take the 25-pound box of nails as issued. (All of the partitions in the chest are made of flange steel, flanged on three sides and riveted through the flanges to the chest.) The middle compartment is fitted to take the field forge in front, the anvil in rear, and several small

# FORCE LIMBLER MODEL OF 1902 MI





tools in brackets on the walls. The anvil is bedded in a wooden seat on the bottom of the chest, and with the forge is held in place by cleats on the chest lid. The latter is held in its open position by a lid prop, which is hinged to a lid-prop bracket riveted to the underside of the lid and having at its other end a button running in a lid-prop guide riveted to one of the chest partitions.

### STORE LIMBER, MODEL OF 1902-M1.

#### WEIGHTS, DIMENSIONS, ETC.

Weight of store limber, empty .....	pounds..	955
Weight of store limber, completely equipped and loaded .....	do.....	1,106
Weight of store limber and store wagon, both completely equipped and loaded .....	pounds..	4,008
Diameter of wheels .....	inches..	56
Width of track .....	do.....	60
Free height under limber .....	do.....	26.5
Turning angle with store wagon .....	degrees..	75

The store limber, model of 1902, M1 is substantially the same as the forge limber, model of 1902, M1 except that the chest is fitted with compartments for carrying the following battery fire-control equipment:

- 10 battery commanders' rulers, wooden.
- 1 battery commander's telescope and mount, in case.
- 1 battery commander's telescope tripod, in case.
- 5 flash lights, with hoods.
- 16 flash lights, without hoods.
- 1 steel tape, 100 foot.
- 2 time interval recorders, with chains.
- Fire-control equipment furnished by the Signal Corps.

The compartments for telephones, field glasses, battery commander's telescope, and battery case are padded to protect the contents from injury.

### BATTERY AND STORE WAGONS, MODEL OF 1917.

#### WEIGHTS, DIMENSIONS, ETC.

Weight of battery wagon, empty .....	pounds..	.....
Weight of battery wagon, completely equipped and loaded .....	do.....	.....
Weight of forge limber and battery wagon, both completely equipped and loaded .....	pounds..	.....
Weight of store wagon, empty .....	do.....	.....
Weight of store wagon, completely equipped and loaded .....	do.....	.....
Weight of store limber and store wagon, both completely equipped and loaded .....	pounds..	.....
Diameter of wheel .....	inches..	56
Width of track .....	do.....	60
Free height under wagons .....	do.....	24.5
Turning angle with limbers .....	degrees..	75
Weight (approximate) at lunette of both wagons, loaded .....	pounds..	112

## Nomenclature of parts.

Number on store wagon.	Number on battery wagon.	Name of part.	Location, etc.	Property classification.	Class.	Section.
2	2	Wheels, with wheel fastenings, complete.	Same as on caisson.....			
1	1	Axle.....				
2	2	Axle brackets.....	Riveted on axle.....			
1	1	Frame complete, consisting of—				
1	1	Side rail, right.....	Main frame.....			
1	1	Side rail, left.....	do.....			
1	1	Rear cross channel.....	Riveted between side rails.....			
1	1	Rear intermediate cross channel.....	do.....			
1	1	Front intermediate cross channel.....	do.....			
1	1	Front cross channel, long.....	do.....			
1	1	Front cross channel, short.....	do.....			
1	1	Wheel-guard cross brace.....	do.....			
1	1	Top plate.....	Riveted between side rails, front.....			
1	1	Lunette bracket.....	Riveted to side rails at front.....			
1	1	Lunette.....	Bolted into lunette bracket.....			
1	1	Lunette nut.....	On end of lunette.....			
.....	1	Side-rail filler.....	Riveted to left side rail near front.....			
2	2	Frame handles (1 right, 1 left).	Riveted to side rails at front.....		IV	3
1	1	Prop complete, consisting of—	Bolted through lunette bracket.....			
1	1	Prop chain.....	Riveted to clamps.....			
2	2	Prop-chain clamps.....	Clamped to prop tubes.....			
2	2	Prop-chain eyes.....	Riveted to top plate.....			
1	1	Prop eye, right.....	Riveted to prop tube, top.....			
1	1	Prop eye, left.....	do.....			
1	1	Prop foot.....	Riveted to prop tube, bottom.....			
2	2	Prop tubes.....	Main body of prop.....			
1	1	Fastening pin with nut and split pin.	Pins 1 prop to frame.....			
1	1	Chain hook.....	Riveted to side rail, left.....			
2	2	Spare-pole brackets.....	Riveted to wheel guard and brace.....			
2	2	Crowbar brackets.....	Riveted to side rail, right.....			
1	1	Pin with split pin.....	In spare-pole brackets.....			
1	1	Chain with rivet, ring and split pin (2.52-inch).	For pin-pole brackets.....			
2	2	Wheel guards.....	Riveted to side rails.....			
2	2	Brake crank shaft bearings (1 right, 1 left).	do.....			
2	2	Carrying-spring brackets.....	Riveted to side rails and chest.....			

## Nomenclature of parts—Continued.

Number on store wagon.	Number on bat- tery wagon.	Name of part.	Location, etc.	Property classification.	
				Class.	Sec- tion.
4	4	Liner brackets (2 right, 2 left).	Riveted to side rails and carrying spring brackets.		
4	4	Liner-bracket braces.....	Riveted to side rails and liner brackets.		
4	4	Liners (2 right, 2 left).....	Riveted to liner brackets..		
1	1	Oil-can carrier, consisting of—	Rear end of frame.....		
1	1	Oil-canbar.....	Fastened to oil-can bar bracket.		
1	1	Oil-can bar bracket with staples.	Riveted to rear cross channel.		
1	1	Oil-can bar catch.....	do.....		
2	2	Oil-can carrier angles (1 right, 1 left).	Riveted to side and bottom plates.		
1	1	Oil-can carrier bottom plate.	Riveted to carrier angles.		
1	1	Oil-can carrier stop....	Riveted to side plates and end of bottom plate.		
2	2	Oil-can carrier side plates (1 right, 1 left).	Riveted to carrier angles and cover channels.		
2	2	Oil-can carrier tees....	Riveted to bottom plate.		
3	3	Oil-can locking plates.	Riveted to oil-can bar.		
3	3	Oil-can strips, intermediate.	Riveted to bottom plate.		
1	1	Oil-can strip, rear.	do.....		
6	6	Oil-can strips, side.	do.....		
1	1	Oil-can strips, at carriage stop.	Riveted to carriage stop.	IV	3
2	2	Stop braces.....	Riveted to carrier tees and stop.		
1	1	Padlock.....	Chained to cross channel.		
1	1	Chain with ring and rivet.	Riveted to cross channel.		
2	2	Steps (1 right, 1 left).....	Riveted to side rails.		
1	1	Rear cross channel reinforcement.	Riveted to rear cross channel.		
1	1	Chest complete, consisting of—			
1	1	Chest front end.....	Riveted at end of chest.		
1	1	Chest rear end.....	do.....		
1	1	Chest front cross partition.	Riveted in chest.		
1	1	Chest rear cross partition.	do.....		
1	1	Chest side, right.....	Riveted at side of chest.		
1	1	Chest side, left.....	do.....		
1	1	Chest top.....	Top of chest.		
1	1	Small door-staple bracket.	Riveted to top side of chest top.		
1	1	Small door hasp.....	Riveted to top side of small doorplate.		
1	1	Small top doorplate.	Top of chest.		
1	1	Small top door reinforcement.	Riveted to chest top around door.		

## Nomenclature of parts—Continued.

Number on store wagon.	Number on battery wagon.	Name of part.	Location, etc.	Property classification.	Class. Section.
		Chest complete, consisting of—Continued.			
.....	1	Fals floor (front lower right compartment)	Bottom of chest.....		
.....	1	Packing stud—			
.....	1	Packing strip No 1	Front lower right compartment.		
.....	1	Packing strip No 2	Front lower left compartment.		
.....	1	.....do.....	Rear lower left compartment.		
.....	1	.....do.....	Rear lower right compartment.		
.....	1	Packing strip No 3	Front lower right compartment.....		
.....	1	Packing strip No 4	Left rear transom only.....		
.....	2	Packing strip No 5	Bottom of chest.....		
.....	1	Rear bottom plate, right	Bottom of chest.....		
.....	1	Rear bottom plate, left.	Bottom of chest.....		
.....	1	Rear chest compartment top plate.	Top of chest, rear.....		
.....	2	Rear door hook.....	Pinned to hook support.....		
.....	2	Rear door hook spring.	On rear door spring.....		
.....	2	Rear door hook support (1 right, 1 left).	Riveted to top back plate.....		
.....	1	Rear doorplate.....	Rear lower compartment.....		
.....	1	Rear pole compartment top plate.	Over pole opening.....		
.....	1	Rear top doorframe.....	Riveted to rear top of chest.	IV	
.....	1	Rear top doorplate.....	Hinged on rear top of chest		
.....	2	Front and rear doorframe.	Front and rear bottom of chest.		
.....	1	Front doorplate.....	Front side of chest.....		
.....	1	Rear doorplate.....	Rear side of chest.....		
.....	1	Foot rest.....	Front of chest.....		
.....	2	Foot-rest clip.....	Riveted to chest and foot rest.		
.....	1	Foot-rest support bracket, right.	Support at right side.....		
.....	1	Foot-rest support bracket, left.	Support at left side.....		
.....	1	Foot-rest support, right.	Riveted on right edge.....		
.....	1	Foot-rest support, left.	Riveted on left edge.....		
.....	1	Front chest compartment top plate.	Front top of chest.....		
.....	1	Front bottom plate, right.	Bottom right side.....		
.....	1	Front bottom plate, left.	Bottom left side.....		
.....	1	Front door reinforce.....	Front side of chest.....		
.....	1	Rear door reinforce.....	Rear side of chest.....		
.....	1	Transom front, right.....	Inside chest.....		
.....	1	Transom front, left.....	.....do.....		
.....	1	Transom, rear, right.....	.....do.....		

## Nomenclature of parts—Continued.

Number on store wagon.	Number on bat- tery wagon.	Name of part.	Location, etc.	Property classification.	
				Class.	Section.
		Chest complete, consist- ing of—Continued.			
1	1	Transom, rear, left....	Inside chest.....		
1	1	Front top door rein- force.	On chest body.....		
1	1	Front pole compart- ment top plate.	In front chest body.....		
2	2	Front-door hinges male.	Riveted to front door....		
2	2	Rear-door hinges, male.	Riveted to rear door.....		
1	1	Front top doorplate...	On chest body.....		
1	1	Front top door rein- force.	do.....		
.....	1	Grindstone-leg brack- et, right end.	In rear-chest compartment		
.....	1	Grindstone-leg brack- et, left end.	do.....		
.....	1	Grindstone racking....	do.....		
.....	1	Grindstone - racking nut.	do.....		
.....	1	Grindstone-leg retainer	.....		
1	1	Handrail.....	Front top of chest.....		
2	2	Handrail brackets, front, right.	Riveted to chest.....		
2	2	Handrail brackets, front, left.	do.....		
4	4	Handrail brackets, rear, right.	do.....	IV	3
1	1	Intermediate bottom plate, right.	Riveted in bottom middle compartment.		
1	1	Intermediate bottom plate, left.	do.....		
2	2	Inner foot-rest chan- nels.	Riveted to foot rest.		
2	2	Lid props.....	Linked to lid-prop filler...		
2	2	Lid-prop guide.....	Riveted to front and rear covers.		
2	2	Lid-prop eye.....	Riveted to top of chest....		
2	2	Lid-prop filler.....	Holds lid-prop in eye....		
2	2	Lock eyes.....	Riveted to chest body....		
2	2	Lock bars.....	Hinged to chest top.....		
4	4	Lock-bar hinge, top...	Riveted to chest.....		
4	4	Lock-bar hinge, top reinforce.	do.....		
1	1	Name plate.....	Front upper part chest body.		
1	1	Outer foot-rest chan- nel, right.	Riveted to foot rest.....		
1	1	Outer foot-rest chan- nel, left.	do.....		
1	1	Rear cross channel re- inforce.	Riveted to rear cross chan- nel.		

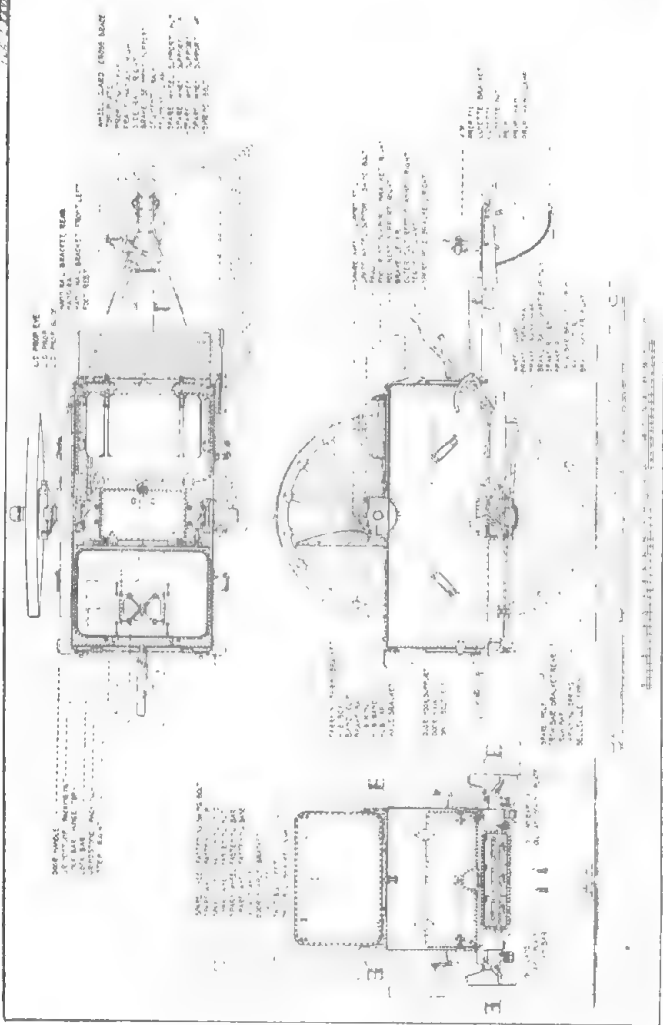
## Nomenclature of parts—Continued.

Number on store wagon.	Number on battery wagon.	Name of part.	Location, etc.	Property classification.	
				Class.	Section.
		Chest complete, consisting of—Continued.			
2	2	Shot-bolt brackets, right.	Riveted to front and rear covers.		
2	2	Shot-bolt brackets, left.	do.		
4	4	Shot-bolt stops.	do.		
4	4	Shot-bolt eye.	Riveted to chest-body side		
4	4	Spare-wheel fastening base.	Riveted to sides chest		
4	4	Spare-wheel fastening clip.	Fastened to base.		
4	4	Spare-wheel fastening nuts.			
6	6	Small door hinge, male	Top of chest.		
1	1	Small top doorframe.	Top of chest body.		
4	4	Spare-wheel fastening bar.	To spare-wheel base.		
4	4	Spare-wheel fastening reinforce.	Inside of chest body.		
4	4	Spare-wheel stud.			
2	2	Spare-wheel swing bolt	Bar to body.		
2	2	Spare-wheel support.	Top of chest body.		
2	2	Spare-wheel support caps.	do.		
2	2	Spare-wheel support clips.	do.		
2	2	Spare-wheel support nuts.			
2	2	Spare-wheel support stud.			
2	2	Spare-wheel support swing bolt.			
1	1	Weather strip 10F.	Small top doorframe.		
1	1	Weather strip 16B.	Top doorframe.		
2	2	Weather strip 17E.	Front and rear doorframe.		
1	1	Weather strip 17B.	Rear top doorframe.		
9	9	Chains 2.52 inches long.	For OW fastenings.		
18	18	Chain rings.	do.		
3	3	Chain rivets.	do.		
3	3	Door handles.	For door fastenings.		
18	18	Door-handle reinforces.			
4	4	Door hinges, male.			
10	10	Door hinges, female.			
10	10	Door-hinge (female) reinforce.			
10	10	Door-hinge pins.			
6	6	Padlocks, Yale, 2-inch, No. 850.	For door fastenings, etc.		
2	2	Padlock-chain rivets.			

IV

3

100-100



**DESCRIPTION OF BATTERY AND STORE WAGON, MODEL 1917.**

(PLATE XXVII.)

The battery wagon is of metal throughout with the exception of parts of wheels. The principal parts are wheels, axle, frame, chest, brakes.

The wheels are the standard 56-inch type and are interchangeable with those under caisson.

The axle is a hollow forging made of one piece.

The frame is of flange steel built up of two side rails of channel section, and one rear cross-channel with intermediate bracing channels. The side channels are bent in near the front and meet to form the seat in which the lunette bracket is riveted. Lunette and bracket are similar to those on caissons. The limber prop is similar to caisson limber prop which is attached to front of the frame. Carrying springs similar to those on the caisson are employed to carrying chest. In the rear of the frame is an oil-can compartment fitted to carry hydroline, lubricating-oil, and coal-oil cans.

The chest is of flange steel divided by plates into compartments which are used for carrying various articles of battery equipment. The top compartments are provided with vertical opening hinged doors, the front and rear doors having lid props and locks. The lower compartments are provided with vertical swing doors in front and rear of chest. Spare wheel fastenings are provided on outside of chest for one spare wheel to be carried on each side. The seat with handrail and paulin straps is provided above the chest. Paulins are used as seat cushions. A perforated flange steel foot rest is provided in front of the seat. A spare limber pole is carried pinned to brackets on rear guard cross brace at the front of frame and running back through the chest, in a pole compartment.

The brakes are similar in operation but different in detail from those on caisson.

The battery wagons and store wagons are identical except that the battery wagon carries a vise on front end of frame and a crowbar bracket below frame on right-hand side and the store wagon contains packing strips and accessories for carrying a grindstone in the upper rear compartment.

**PADLOCKS AND BOLT SNAPS.**

The padlocks furnished for each separate vehicle, as carriage, forge limber, battery wagon, store limber, or store wagon, excepting the limbers and caissons, will have keys interchangeable for all locks of that particular vehicle but differing from all others.



Limbers and caissons are furnished with a lock, marked "**AMMUNITION**," which has only one key, these being universally interchangeable.

Bolt snaps for temporarily securing doors, etc., are placed where no shot bolts are provided.

### BREAST-COLLAR HARNESS.

The component parts of the breast-collar harness are given in the table below. Plate XXVIII shows the harness for the off-wheel horse and the off lead swing horse. The nomenclature as given in the table is also given and the particular parts designated on the plate.

At either end the breast collar is toggled to the trace; in front it is held down by a chokestrap which passes between the forelegs and is buckled around the cincha. On the wheel horse, the neck strap and neck-yoke neck strap are held in a collar pad which is hooked to the pommel by the pad strap and pad-strap hook. The neck-yoke neck strap encircles the neck and is fastened to the yoke pole.

#### Component parts.

	Wheel.		Lead.		Property classification.	
	Near horse.	Off horse.	Near horse.	Off horse.	Class.	Section.
Backstrap and crupper, complete, consists of—						
Body.....			1	1		
Hip strap.....			2	2		
Crupper dock.....			1	1		
Loin strap.....			1	1		
Trace loops.....			4	4		
Backstrap hook.....			1	1		
Breast collar, complete, consists of—						
Breast collar.....	1	1	1	1		
Chokestrap.....	1	1	1	1		
Neck strap.....	1	1	1	1		
Collar pad, assembled.....	1	1				
Body.....					IV	8
Buckle chapes.....						
Pad strap with hook.....						
Neck-yoke neck strap.....	1	1				
Breeching, complete, consists of—						
Body.....	1	1				
Backstrap.....	1	1				
Hip straps.....	4	4				
Backstrap hook.....	1	1				
Crupper dock.....	1	1				
Side straps.....	2	2				
Side-strap hooks.....	2	2				
Trace loops.....	2	2				
Loin strap.....	1	1				



## Component parts—Continued.

	Wheel.		Lead.		Property classification.	
	Near horse.	Off horse.	Near horse.	Off horse.	Class.	Section.
<b>Bridle, complete (model of 1913), consists of—</b>						
Brow band.....	1	1	1	1		
Brow-band ornaments.....	2	2	2	2		
Crownpiece.....	1	1	1	1		
Crownpiece strap.....	1	1	1	1		
Coupling strap.....		1		1		
Reins.....	1	1	1	1		
Snaffle bit <sup>1</sup> .....	1	1	1	1		
<b>Halter, complete, consists of—</b>						
Crown strap.....	1	1	1	1		
Cheek piece.....	2	2	2	2		
Crown chape.....	1	1	1	1		
Nose band.....	1	1	1	1		
Chin strap.....	1	1	1	1		
Throat band.....	1	1	1	1		
Throat strap.....	1	1	1	1		
Halter square.....	2	2	2	2		
Tie rope.....	1	1	1	1		
<b>Martingale, complete, consists of—</b>						
Martingale.....	1	1				
Cincha strap.....	1	1				
<b>Saddle, complete, consists of—</b>						
Cinchas, with reinforces and loops.....	1	1				
Cinchas, without reinforces and loops.....			1	1		
Lead rein roller and strap.....		1		1		
Quarter straps, side, including rings and safes.....	2	2	2	2	IV	8
Quarter strap, pommel.....	1	1	1	1		
Quarter strap, cantle.....	1	1	1	1		
Cincha strap.....	2	2	2	2		
Coat strap, 33-inch (pommel).....	3	2	3	2		
Coat strap, 45-inch (cantle).....	1	1	1	1		
Coat strap, 60-inch.....		2		2		
Saddletree, leather covered.....	1	1	1	1		
Stirrups, model of 1912.....	2	2	2	2		
Stirrup straps.....	2	2	2	2		
Saddlebags, pairs.....		1		1		
Saddlebags, side straps.....		2		2		
<b>Traces, lead, model of 1908, consists of—</b>			2	2		
1 trace body.....						
1 trace cover.....						
3 links.....						
1 chain.....						
1 toggle.....						
2 sockets.....						
2 cones.....						
2 filler pieces.....						
<b>Traces, wheel, model of 1908, consists of—</b>	2	2				
1 trace body.....						
1 trace cover.....						

<sup>1</sup> Twenty curb bits and chains per battery are issued for use in place of snaffle bits with fractious horses.

*Component parts—Continued.*

	Wheel.		Lead.		Property classification.	
	Near horse.	Off horse.	Near horse.	Off horse.	Class.	Section.
Traces, wheel, model of 1908, consists of—						
Continued.						
1 ring .....					IV	8
2 sockets .....						
2 links .....						
2 chains .....						
2 toggles .....						
2 cones .....						
2 filler pieces .....						
Mogul spring, assembled .....						
1 loop hook .....						
1 ring .....						
1 locking strap .....						
Trace chain body .....						
Whip .....	1		2	2		
Sweat leathers .....	2	1	1	1		
Blanket .....	1	1	1	1		

\* In submitting and in filling requisitions, unless it is specifically stated that saddle blankets are wanted, they will not be included.

## THE CARE AND PRESERVATION OF LEATHER.

Attention is invited to the following:

"It is forbidden to use any dressing or polishing material on the leather accouterments or equipments of the soldier, the horse equipments for cavalry, or the artillery harness except the preparations supplied by the Ordnance Department for that purpose." (A. R. 293 of 1913.)

### REASON FOR OILING LEATHER.

Leather, as it comes from the tannery in manufacture, is hard, rough, brittle, inflexible, and readily absorbs water. To remove these undesirable qualities and render the leather soft, pliable, flexible, and impervious to water, to increase the strength and toughness of the fiber, and to give the leather such a surface color and finish as will make it most sightly and suitable for the purpose for which intended, the manufacture is continued by hand stuffing it with a dubbing made of pure cod-liver oil and tallow, which the experience of curriers has shown to be the best material for this purpose. This dubbing is thoroughly absorbed by the leather, penetrating it completely, and is not merely limited to the surface.

The russet leather now used by the Ordnance Department in the manufacture of all leather equipments is pure oak tanned, of No. 1 tannage and finish, hand stuffed with a light dubbing made of pure cod-liver oil and tallow to preserve the leather, the dubbing being so sparingly used that the oil will not exude. This leather as it comes from the manufacturer contains enough oil to materially improve its quality and prolong its life, but not enough to soil the clothing if the equipment is properly cared for. No oil whatever is added to the leather in the manufacture of the equipments at the Government arsenals.

#### CARE OF RUSSET LEATHER.

Leather equipments which have become wet should be dried in the shade. Wet leather exposed to the direct rays of the sun or to the heat of a stove or radiator becomes hard and brittle.

When russet-leather equipments become soiled in service they should be cleaned by carefully washing the leather with a sponge moistened with a heavy lather made of clean water and Castile or Frank Miller's soap, and then rubbing vigorously with a dry cloth until the leather is completely dry.

If the leather becomes harsh, dry, and brittle from exposure to water or other causes, clean as above described, and while the leather is still slightly moist apply an exceedingly light coat of neat's-foot oil by rubbing with a soft cloth moistened (not saturated) with the oil. If it is found that too much oil has been used, the surplus can be readily removed by rubbing with a sponge moistened with naphtha or gasoline. But these oils are not issued for this purpose.

Where a polish is desired, the leather should first be thoroughly cleaned and then the leather polish or dressing supplied by the Ordnance Department should be applied sparingly and thoroughly rubbed in with a soft, dry cloth. Scars, cuts, or abrasions of the leather may be improved in appearance but not obliterated by similar use of the leather polish.

Russet leather may be cleaned, oiled, and polished as described above, but it should be noted that if more than a light coat of oil be given the leather will be greatly darkened and will quickly soil the clothing. No method of cleaning will restore the original light color of the leather or remove stains or discolorations.

#### CARE OF BLACK LEATHER.

To clean and dress black leather, wash it in water (lukewarm preferred) with Castile soap. An old horse brush will be found very satisfactory for applying the soap and water. Dry in the

shade; when almost dry, apply the blacking, rubbing it in thoroughly.

Dry in the shade and then apply neat's-foot oil with a sponge or rag, rubbing in well until the leather is soft and pliable.

When dry, a certain amount of oil and blacking will exude from the leather; this should be rubbed off with a dry cloth.

## SIGHTS.

The instruments for sighting and laying the piece include a rocking bar sight, and panoramic sight.

### ROCKING-BAR SIGHT.

The rocking bar sight consists principally of a rocking bar and a sight bar. The rocking bar is pivoted horizontally at the front end to an arm on the left trunnion of the cradle. A bracket is riveted to the underside at the rear end to carry the angle of site level. An open square socket is formed in the bracket for the reception of a similar shaped projection on the arc bracket of the range gear, by which the reciprocating motion of the elevating screw is conveyed to the bar. The rear end is provided with a crosshead in which works a traversing screw with milled heads, and a nut which enables 90 mils of deflection right or left to be given to the sight bar.

The sight bar is pivoted vertically about its center to a socket with an adjustable bushing in the rocking bar. The rear end of the bar is fixed to the traversing nut. The nut on the traversing screw is in two parts having a spring inserted to keep the halves apart; the object of this arrangement is to take up backlash in the deflection gear due to the wear of the screw. A cap is provided for the protection of the sight. The rocking bar sight is removable, being attached to the trunnion arm and arc bracket by nuts and pins.

The permanent angle for drift is given by the axis of the cradle being inclined at an angle of  $1\frac{1}{2}$  degrees, the left trunnion being the lower, so that as elevation is given the gun muzzle moves to the left the necessary amount to correct for drift. The angle of site level attached to the bracket of the rocking bar admits of 200 mils elevation and 200 mils depression.

### ANGLE OF SITE.

The angle of site level consists principally of a level bracket with leveling screw and a-level holder trunnioned to the upper part of

the bracket. To the rear end of the leveling screw is attached the micrometer disc, having 100 divisions, so that one of these divisions corresponds to one mil ( $1/1000$  of the range) used on the panoramic sight. The level holder has a toothed segment meshing with the leveling screw and marked 2, 3, 4, and 5, and in connection with the micrometer disc are read 200, 300, etc., plus the indication of the latter. The 3 or 300 mark corresponds to the mean or zero position of the holder, and, in measuring the angle of site, the reading of the level scale should be subtracted from 300, the algebraic sign of the result indicating whether the angle of site is negative or positive, i. e. target below or above gun.

#### ROCKING-BAR SIGHT—ALIGNMENT TESTS.

Before any of the following operations are carried out, the carriage should be first placed on a firm platform, or on hard, level ground and manipulated until the gun is level transversely. The breech mechanism is then removed and fine threads or hairs stretched across the muzzle and breech axis lines, form a good bore sight. To align the rocking bar sight with the axis of the bore, first set the sight at zero deflection, and, lay the bore accurately on some point at least 2,000 yards distant. The open sights should now be on the distant point, if not, correct as follows: Loosen the clamping screw below the foresight and screw the acorn of the sight up or down until the line of sight is on the distant point. There is no adjustment for transverse error as this error is not important, and not likely to be large.

Plate shows a target of dimensions, placed in a vertical position perpendicular to the line of sight, at such a height that the point "Bore" is at the same height as the axis of the bore of the gun. This target may be used when no clearly defined object is available. It should be placed about 50 yards from the gun.

Care must be taken that the bubble of the angle of site level remains in the center of its run while carrying out this test, which it will do if the lower elevating handwheel is not interfered with.

Place a spirit level on the muzzle end of the guide ribs on the gun and bring the bubble level by working the upper elevating handwheel. The yard and degree scale ring should then be reading zero. If it does not, remove the split pin from the end of the spindle, slack back the nut of the jamming plate, turn the scale ring to zero by hand, see that the bubbles of both spirit levels are still central, and reclamp.

## PANORAMIC SIGHT, MODEL OF 1917.

(PLATE XXIX.)

The panoramic sight is a vertical telescope so fitted with an optical system of reflecting prisms and lenses that the gunner with his eye at the fixed rubber eyepiece (RE) can bring into the field of view an object situated at any point in a plane perpendicular to the axis of the telescope.

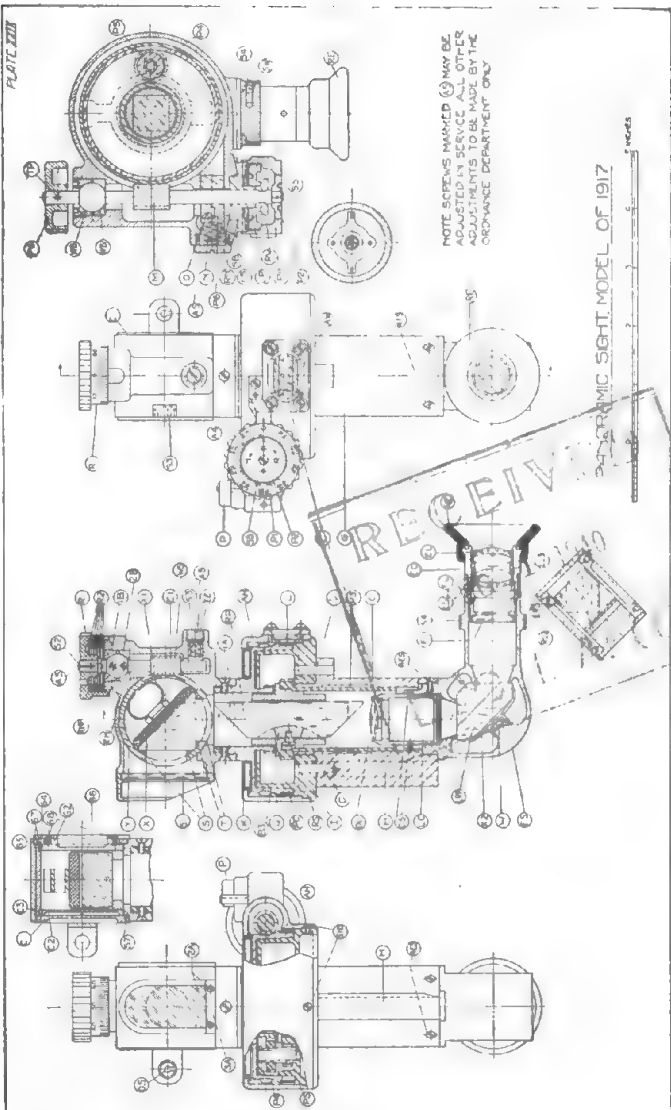
## OPTICAL SYSTEM.

The rays coming from the object are reflected downward from the rotating head prism (RHP) into the rotating prism (RP). The rotating prism (RP) rectifies the rays; after their passage through the achromatic objective lens (OL), the lower reflecting prism (LRP) reflects them in such a way that there is presented to the eye lens (EL) a reflected image, which the eyepiece magnifies. A characteristic of the rotating prism is that upon rotation about its longitudinal axis the image of the object seen through it turns with twice the angular velocity of the rotating prism. The rotating head prism and rotating prism are so mounted as to rotate about this axis, the rotating prism following the rotating head prism with one-half of the angular velocity of the latter; the image always remains as it would appear to one observing it directly with an ordinary telescope. The image formed by the achromatic objective lens (OL) would then be reversed and inverted. The rays are cross reflected to the opposite sides of the axis by the inclined faces of the lower reflecting prism, thus correcting the reversal.

The combined action of the rotating head prism (RHP), the rotating prism (RP), and lower reflecting prism (LRP), and the nature of action varying with different positions of the prisms provide for the correction of the inversion of the image. The rotating head prism (RHP) and lower reflecting prism (LRP) as shown in position on Plate XXIX act as parallel reflectors, and they without the lens system would present an erect image. The rotating prism (RP), however, inverts the rays and corrects the inversion produced by the achromatic objective lens (OL). It will be noted that the effect is the same whether the rotating prism (RP) occupies the position shown on the plate or is revolved  $180^\circ$  from that position.

The rotating head prism (RHP) must be turned through  $360^\circ$  to obtain a rotation of  $180^\circ$  for the rotating prism (RP). If the rotating head prism (RHP) is rotated through  $180^\circ$ , the rotating prism (RP) and lower reflecting prism (LRP) would form reflectors set at





right angles, and would give, without the lens system, an inverted image, and in conjunction with the lens system an erect image. The rotating prism (RP) in this case will occupy a position of  $90^\circ$  from that shown on the plate, in which position it causes no inversion, but counteracts the inversion produced by the lower reflecting prism (LRP).

The instrument has a magnifying power of 4, and a field view of  $10^\circ$

### THE PRINCIPAL PARTS.

The principal parts of the panoramic sight are the rotating head mechanism, the elevating device, the azimuth mechanism, the rotating prism mechanism, the counting device, the shank, and the elbow.

#### ROTATING HEAD MECHANISM.

The rotating head mechanism consists principally of the rotating head (RH), rotating head prism (RHP), rotating head prism holder (Y), prism holder cover (C2), elevation index support (G2), prism shield (S1), and rotating head cover (C1).

The rotating head (RH) forms a housing for its movable parts, and provides seats for the elevation-worm ball socket and cap (2B and 1B), and rotating head prism holder (Y). The front opening of the rotating head is closed by the prism shield (S1) which forms a dust guard. The bottom threaded seat of the rotating head screws upon the upper end of the azimuth circle (J) and is locked in place by four rotating head retaining screws (1A). Upon the rear face of the rotating head (RH) is engraved a scale (G3), which is used for measuring the elevation of the rotating head prism holder (Y), which retains the rotating head prism (RHP), and has an index mark upon the projection coinciding with the graduations of the elevation micrometer (R1), thus measuring the angle of site.

The rotating head prism (RHP) is mounted within the rotating head prism holder (Y), between the prism support front (S), prism support bottom (T), and prism support back (X), and is secured in position by the rotating head prism spring (XI), which bears upon the prism support back (X). The rotating head prism (RHP) is protected on the right side by the prism holder cover (C2) and on the left side by the elevation index support (G2). The movement of the rotating head prism holder (Y), upon which the elevation segment (WS) is cut, is accomplished by the elevation worm (E1) and the length of travel is controlled by seven brass stop rings (R2). Each ring has a small tongue, the edge of which engages at each revolution of the elevation worm (E1) with the tongue on the ad-

jacent ring. Each ring is thus engaged in its turn until six revolutions have been made, when the tongues are all in contact and no further movement can be made in that direction.

The prism shield (S1) is held within the rotating head (RH) by the prism shield retaining piece (3A), which is in turn secured by two prism shield retaining piece screws (2A).

The prism holder cover (C2) screws into its threaded seat, located in the right side of the rotating head prism holder (Y), and is locked in position by the prism-holder cover screw (C3).

The rotating head cover (C1) screws into its threaded seat, located in the right side of the rotating head (RH), and is held in place by the rotating head cover screw (S7). The exterior of the rotating head cover (C1) has two small holes for test wrench, and engravings "Field 10°" and "Power 4" are located on the exterior surface.

The elevation index support (G2) screws into its threaded seat located in the left side of the rotating head prism holder (Y) and is secured in place by the elevation index support screw (G7). The small holes in the exterior surface allow the use of a test wrench to enable the elevation index support (G2) to be screwed in place. The support retaining ring (G4) retains the elevation index support with rotating head prism holder within the rotating head and is locked in position by the supporting ring screw (G5).

The elevation index (G6) is held upon the elevation index support (G2) by the two elevation-index retaining screws (G8). The arrow engraved upon the German silver piece which is dovetailed in the elevation index (G6) coincides with the graduations of the scale (G3) engraved upon the rear face of the rotating head (RH).

#### ELEVATION DEVICE.

The elevation device consists principally of the elevation segment (WS), elevation worm (E1), elevation worm ball cap and socket (1B and 2B) elevation worm plunger spring and plug (S3 and E2), elevation micrometer (R1), seven stop rings (R2), and elevation index (G6).

The elevation segment (WS) is hobbled into the rotating head prism holder (Y) and meshes with the elevation worm (E1).

The elevation worm (E1) is mounted in the back of the rotating head (RH) in a ball and socket bearing (2B) which in conjunction with the elevation worm plunger spring (S3) and plunger (E2) prevents backlash between the elevation worm (E1) and the elevation segment (WS).

The elevation micrometer (R1) is held upon the upper slotted end of the elevation worm (E1) by the micrometer locking screw short (S2). The scale engraved upon the periphery is graduated into 100 equal divisions, numbered every 10 divisions. The upper exterior diameter of the elevation worm micrometer head is straight knurled to facilitate turning. One complete revolution of the elevation micrometer (R1) is equal to the distance between each graduation upon the scale (G3) on the rear face of the rotating head. Each graduation represents 100 mils and the scale (G3) is so planned that the line of sight is horizontal when it reads 3.

#### OPEN SIGHT.

The open sight (OS) is constructed of bronze plate bent to shape having an arm projecting out at each end, each arm containing a hole. A bronze knee is soldered to the interior of the front projecting arm over the center of the hole in such a manner as to form a sight which is used for quick sighting. The open sight (OS) is secured to the rotating head cover by two open sight retaining screws.

#### AZIMUTH MECHANISM.

The principal parts of the azimuth mechanism are the azimuth circle support (I), azimuth circle (J), azimuth worm (M), bearing socket (WB1) and bearing cap (WB), throw-out plunger (P6) and spring (N), spring plate for azimuth circle (K), azimuth circle hood (AH), azimuth micrometer (P1), azimuth index (A4) and micrometer index (P2).

The azimuth circle support (I) screws on the shank (G), to which it is pinned by two dowels (D). The rotating prism held by a screw in its holder is screwed into the supporting sleeve (P3) and then placed in the shank (G). The azimuth circle (J) rests on the tapering wall of the azimuth circle support (I), being held in place by the spring plate for azimuth circle (K) which along with the azimuth circle hood (AH) covers the rotating parts of the azimuth mechanism. The spring plate (K) furnishes the necessary friction between the azimuth circle (J) and the azimuth circle hood (AH). In the left side of the azimuth circle hood (AH) the azimuth worm (M) is held in a ball and socket bearing (WB) so that by means of a throw-out jam (O) the worm (M) may be thrown out of mesh with the azimuth circle (J) for quick approximate adjustment in sighting, but is normally held in mesh by the throw-out plunger (P6) and spring (N).

The German silver strip on the bottom of the azimuth circle is divided into 64 equal divisions and each even number is numbered. As each complete turn of the azimuth worm (M) rotates the azimuth circle (J) one division, and the azimuth micrometer is graduated in 100 divisions, each division on the azimuth micrometer (P1) represents  $1/6400$  of the circumference, or 1 mil. Therefore an angular movement of one division on the azimuth micrometer causes a lateral displacement of so near  $1/1000$  of the range that the difference is disregarded. Thus the numbers read through the azimuth circle window (AW) represent hundreds of mils, and the reading on the azimuth micrometer (P1) represent mils. On the azimuth micrometer starting from 0 in each direction, every 10th division is numbered in red or black, those in red giving left deflection and those in black right deflection. The micrometer index (P2) has two arrows one marked "L" and the other "R" engraved on it; the "R" filled in in black and the "L" in red. The azimuth index arrow is filled in with black. As the micrometer index (P2) is fastened tightly to the azimuth worm (M) it must turn with it but the azimuth micrometer (P1) does not as the locking spring (LS) and deflection locking plate (LP) prevent it from turning when the azimuth worm (M) is turned. As the azimuth micrometer (P1) may be turned independently of the worm (M) it can be so set as to be used for a counting device.

The shank (G) forms a body for the instrument and provides a seat for the azimuth circle support (I) to be doweled to and a thread at the lower end for the elbow (E5) to screw into. On the front of the shank (G) is a T lug (H) that fits into a T slot at the top of the rear sight in which it is held by a screw with knurled head.

#### ROTATING PRISM MECHANISM.

The rotating prism mechanism consists principally of: The rotating prism (RP), rotating prism holder (PC), supporting sleeve for rotating prism (P3), and the pinions for rotating prism and rotating head (P4). The azimuth circle (J) is geared, by means of two pinions (P4) turning on the pinion shaft (PS) set in the azimuth circle support (I), to the rotating prism holder (PC), so that the angular movement of the rotating head (RH) is twice that of the rotating prism holder (PC). The rotating prism (RP) is retained in the rotating prism holder (PC) by a set screw (RS) and a block (B3) cemented to the rotating prism (RP) after the prism is ground out to fit it.

## ELBOW.

The principal parts mounted in the lower end of the elbow are: The reticule (F), reticule cell (RC2), achromatic field lens (FL), achromatic eye lens (EL), eye lens cell (EC), and rubber eyepiece (RE).

The achromatic objective lens (OL) is mounted in the upper end of the objective lens cell (LC). This cell is secured in its threaded seat in the upper end of the elbow (E3) by two objective lens cell retaining screws (CS).

The elbow is screwed in the lower end of the shank (G) and secured by the four elbow retaining screws (4ES) in such a manner that its projecting arm is perpendicular to the axis of the instrument.

The lower reflecting prism (LRP) remains stationary, as it is firmly pressed against seats machined in the elbow (E5) by a holder (X2) fitted to a seat at the bottom of the elbow. The tension of this holder is regulated by a wedge (W) to the required amount. Upon the right side of the elbow (E5) is an opening through which the light is thrown upon the reticule (F). This opening is covered by the window (SW) to protect the interior of the eyepiece from dust and dirt. The shutter (S4) is so designed to slide over the opening in the elbow (SW) being guided by the shutter stop screw and movement limited by the elongated slot.

The reticule (F) has two cross lines etched on its surface and is mounted in the forward end of the reticule cell (RC2) which is secured in the eye lens cell (EC) by the reticule cell retaining screw. The horizontal cross line of the reticule is graduated in mils.

The achromatic eye lens (EL) is mounted in the eye lens cell (EC) and is separated from the achromatic field lens (FL) by the lens separator (LC3). The achromatic field lens (FL) is held within the eye lens cell (EC) by the field lens retaining ring (LR3), which in turn is locked by the field lens cell retaining ring screw. The eye lens cell is secured to the elbow by the eye lens cell retaining screw (ES1).

All interior metallic surfaces exposed to the refracted light are finished with dull black baking enamel. All exposed optical elements, covers, and non-rotating joints are sealed with the litharge cement or equal. All German silver graduated surfaces are sand-blasted and lacquered.

NOTE. Screws marked (AS) may be adjusted in service. All other adjustments to be made by the Ordnance Department only.

*Nomenclature of parts of panoramic sight, model of 1917.*

Symbol.	Name of part.	Symbol.	Name of part.
1	AH Azimuth-circle hood.	44	M Azimuth worm.
2	AW Azimuth-circle window.	45	N Spring.
3	1A Rotating - head retaining screw.	46	O Throw-out cam.
4	2A Prism - shield retaining piece screw.	47	OL Achromatic objective lens.
5	3A Prism - shield retaining piece.	48	OS Open sight.
6	A4 Azimuth index.	49	P Throw-out lever.
7	1B Elevation-worm ballcap.	50	PC Rotating-prism holder.
8	2B Elevation-worm ball socket.	51	PS Pinion shaft.
9	B3 Block in rotating prism.	52	P1 Azimuth micrometer.
10	CS Objective lens cell retaining screw.	53	P2 Micrometer index.
11	C1 Rotating-head cover.	54	P3 Supporting sleeve for rotating prism.
12	C2 Prism-holder cover.	55	P4 Pinions for rotating prism and rotating head.
13	C3 Prism-holder coverscrew.	56	P5 Azimuth-worm knob.
14	D Dowel pin.	57	P6 Throw-out plunger.
15	EC Eye-lens cell.	58	RC2 Reticule cell.
16	EL Achromatic eye lens.	59	RE Rubber eyepiece.
17	ES1 Eye-lens cell retaining screw.	60	RH Rotating head.
18	E1 Elevation worm.	61	RHP Rotating head prism.
19	E2 Worm-plungerspring plug.	62	RN Spring-retaining nut.
20	4ES Elbow-retaining screw.	63	RP Rotating prism.
21	E5 Elbow.	64	RS Rotating-prism holder screw.
22	F Reticule.	65	RW Retaining washer.
23	FL Achromatic field lens.	66	R1 Elevation micrometer.
24	G Shank.	67	R2 Stop ring.
25	G2 Elevation-index support.	68	S Prism-support front.
26	G3 Scale.	69	SB Index-knob washer.
27	G4 Support-retaining ring.	70	SW Window.
28	G5 Support - retaining ring screw.	71	S1 Prism shield.
29	G6 Elevation index.	72	S2 Micrometer-locking screw, short.
30	G7 Elevation-index support screw.	73	S3 Worm-plunger spring.
31	G8 Elevation-index retaining screws.	74	S4 Shutter.
32	H "T" lug.	75	S5 Micrometer-locking screw, long.
33	5HS Azimuth-circle hood screw.	76	S7 Rotating-head cover screw.
34	I Azimuth-circle support.	77	T Prism-support bottom.
35	J Azimuth-circle.	78	TP Taper pin.
36	K Spring plate for azimuth circle.	79	W Wedge.
37	L German-silver strip.	80	WB Bearing cap.
38	LC Object lens cell.	81	W Bearing socket.
39	LP Deflection locking plate.	82	WS Elevation segment.
40	LRP Lower reflecting prism.	83	X Prism-support back.
41	LS Locking spring.	84	X1 Rotating head - prism spring.
42	LC3 Lens separator.	85	X2 Lower reflecting-prism holder.
43	LR3 Field-lens cell retaining ring.	86	Y Rotating head-prism holder.

#### USE OF THE PANORAMIC SIGHTS, MODEL OF 1917.

*For direct aiming.*—Set the rocking bar sight at the required elevations and correct the difference of level of wheels; set off the desired deflection on the azimuth circle of the panoramic sight; bring the crosslines of the sight upon the target by means of the elevating and traversing devices of the carriage. For imparting the approximate initial direction the line sight may be used with advantage.

In using the model of 1917 sight for direct fire care must be taken that the rotating head be set at 300 mils and the deflection mechanism.

*For indirect aiming.*—Set the rear sight at the required elevation and make correction for difference of level of wheels; set the azimuth circle of the panoramic sight at the deflection ordered. Lay the gun for deflection by directing the vertical line of the panoramic sight at the auxiliary aiming point.

The angle of deflection to be set off on the azimuth circle of the panoramic sight is the same as the angle made by joining the target and the auxiliary aiming point with the sight.

#### CARE OF THE PANORAMIC SIGHT, MODEL OF 1917.

These sights are delicate instruments, and must not be subjected to any rough usage, jars, or strains. In firing they remain in position on the carriage; in the field when not in use they are kept in the padded leather cases prepared for them on the rear of the main shield.

To obtain satisfactory vision, the glasses must be perfectly clean and dry. The T lug on the sight and the slot forming its seat should be kept lightly oiled as a preventive of rust. The worm and worm rack should be oiled with vaseline. When dust accumulates on the pointers it should be removed by a fine camel's-hair brush in the hands of an experienced person.

To clean the rotating-head window and the front face of the rotating head, do not remove the rotating-head window from the window cell.

In panoramic sights the exposed optical elements and all non-moving joints are sealed and no attempt should be made to remove them.

#### ADJUSTMENTS OF SIGHTS.

The sights are correctly adjusted when, at zero elevation and deflection the line of sight is parallel to the axis of the bore.



### ALIGNMENT OF PANORAMIC SIGHT, MODEL OF 1917.

Direct the panoramic sight by means of the azimuth micrometer and rear sight scroll gear until its line of sight is parallel to the axis of the bore. The method of determining when this condition of parallelism exists is described hereafter. Without disturbing the direction of this line of sight move the azimuth micrometer of panoramic sight and the range strip of the rocking bar sight until the zero marks come opposite their respective indices. The azimuth micrometer may be moved after loosening the locking screw in the end of the worm. This locking screw may be loosened by the combined teat wrench, and screw driver used for the purpose. If the azimuth micrometer can not be readily removed, grasp the sight by the azimuth micrometer, release the worm from the worm gear of the azimuth circle, and gently tap the exposed end of the worm with small piece of wood or soft metal.

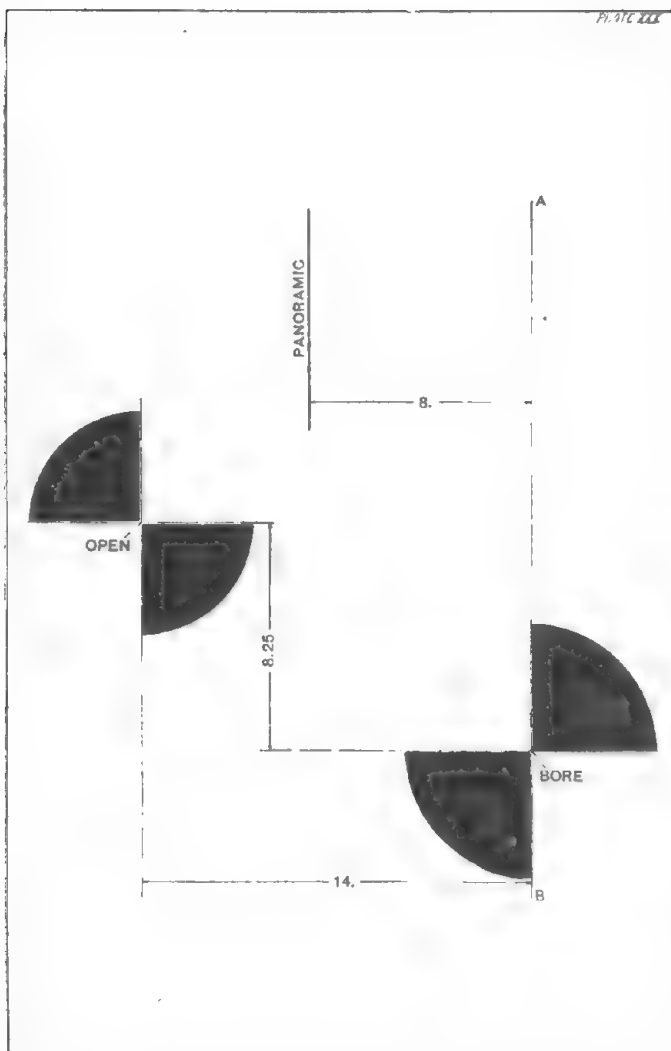
To locate the index opposite the zero of the scale loosen the four screws that hold the movable index cover in place and move this cover until the index is properly located; then tighten the screws. Movement of the range strip of the rear sight is made possible by a slot in the shank in which the range strip screw can be moved when the nut has been loosened.

### VERIFICATION OF PARALLELISM OF LINES OF SIGHTS AND AXIS OF BORE.

The adjustment of the sights is of much importance and should be verified so frequently that battery commanders will find it advantageous to make permanent arrangement for such verification where possible. The leveled supports constituting the carriage emplacement should preferably be of stone. The site of the target should be prepared, and the exact locations of the target and horizontal reference points permanently marked. If these arrangements are properly made, subsequent verifications of sights and quadrants will become a simple matter.

A target of dimensions given in Plate XXX is placed in a vertical position perpendicular to the line of sight, at such a height that the point "bore" is at the same height as the axis of the bore of the gun. The verticality of the target is assured by a plumb line attached at A, coinciding with the vertical line A B.

The carriage is placed with the wheels and trail resting upon solid supports of wood or stone, the surfaces of which have been carefully leveled, so as to bring the axle horizontal. Now direct the gun so that the prolongation of the axis of the bore, as deter-



mined by the bore sights, pierces the target at the proper joint, the lines of sight of the open and panoramic sights are then adjusted in direction by the means explained above until they pierce the targets in the points marked, respectively, "open" and "panoramic."

The axis of the bore is determined and prolonged by means of bore sights. In the absence of such means a breech-bore sight may be made from an empty cartridge case from which the primer has been removed; a piece of paper should be pasted over the primer seat and a pinhole made in its exact center to serve as a peep sight. If the cartridge case does not completely fill the bore, it should be skimmed all around with tissue paper until it does so. For a muzzle-bore sight, use should be made of the traces of the horizontal and vertical planes containing the axis of the bore, which are marked on the muzzle of the gun. Fine threads or hairs stretched across the muzzle to coincide with these lines form a good bore sight, and the ends of such threads may be conveniently fastened to a cloth strap buckled around the muzzle of the gun.

In the field, where from lack of time or proper facilities the method just given can not be followed, the adjustment of the sights may be verified by bringing the lines of sight at zero elevation and deflection to bear upon some sharply defined point of a distant object. At such a range (for instance, 2,000 yards or more) the parallax may be neglected, and if the sights are correctly adjusted the lines of sight and the prolongation of the axis of the bore will sensibly pass through the selected aiming point.

#### ADDITIONAL TESTS.

After the sights are adjusted they should be subjected to the following tests to insure their accuracy at extremes of elevation and azimuth:

(a) With carriage level and gun and sights at zero elevation and deflection, the lines of sight and axis of bore prolonged pierce the target (fig. 1) in the proper points.

(b) The gun is then moved to its maximum elevation; as the sight elevation is altered, the lines of sight should follow the vertical lines through the same points of the target (fig. 1).

(c) With conditions as in (a), the gun is moved upon the carriage to its extreme positions in azimuth; as the sight deflections are now altered, the lines of sight should follow the horizontal lines through the same points on the target (fig. 1).

By construction and assemblage the sights, if correctly adjusted, should fulfill the above conditions with substantial accuracy.

error be noted, a report of the facts of the case with the cause, if known, should be made to the Ordnance officer charged with the repair of the material for his information and action.

#### SPARE SIGHTS.

To each battery is issued one set of spare sights, consisting of one panoramic sight. These parts are carried in a special chest in the battery wagon. One set of bore sights (consisting of one breech and one muzzle bore sight) and one level for use in adjusting sights, etc., are also issued to each battery.

#### ADJUSTING INSTRUMENTS.

A complete detailed description of the method of disassembling and adjusting the different instruments is given in Ordnance Office Pamphlet No. 1795, Instructions for the Care, Preservation, Repair, and Adjustment of Instruments for the Fire-Control System for Coast and Field Artillery. Attention is invited to General Orders No. 47, War Department, March 24, 1905, with reference to the care and repair of panoramic sights, battery commander's telescopes and range finders.

No disassembling of instruments except as prescribed herein will be permitted. The disassembling of telescopic instruments allowed herein must be done only in the presence of a commissioned officer. Disassembling as permitted in Pamphlet 1795 must be done only by officers or employees of the Ordnance Department.

#### ACCURACY OF FIRE.

The two essentials for good shooting are good matériel and skillful personnel. There is practically no limit to improvement in personnel, which may be accomplished by careful training. Improvements in matériel are the subject of constant investigation.

#### CAUSES OF INACCURACY.

The chief causes of unavoidable inaccuracy are -

(a) Variations in the action of the gun and mount and in the ammunition.

(b) Variations in the atmospheric conditions, the effects of which can not be determined accurately.

#### INACCURACIES FOR PERCUSSION FIRE.

Variations in the action of the gun and mount cause a variable "jump," which alters the angle of departure.

Variations in the powder charges and projectiles cause variations in the initial velocities, and the flight of the projectile is further influenced by the variations in the atmospheric conditions.

#### INACCURACIES FOR TIME FIRE.

In addition to the above causes for inaccuracy for percussion fire, the principal causes for inaccuracy of time fire are variations in the action of the fuze, which arise from variations in

- (a) Time of ignition of time train.
- (b) Rate of burning of the time train.
- (c) Time of transmission of the flame from the time train to the base charge.

#### RANGE ERRORS.

We are principally concerned with the inaccuracies in range, since those in the lateral direction, due to matériel, are so small as to be negligible. However, the latter are given also.

From firings conducted with each type of gun and ammunition, from which the errors of personnel have been eliminated so far as practicable, range tables are compiled, and a measure of the accuracy is obtained in the following manner:

From the ranges and deviations obtained at each elevation the mean values are computed. The difference of each round from the mean value gives the error, and the mean of the errors affords a measure of the accuracy.

The following table illustrates this method:

No. of rounds.	Range.	Variation from mean.	Deviation right, drift.	Variation from mean.
	<i>Yards.</i>	<i>Yards.</i>	<i>Yards.</i>	<i>Yards.</i>
1.....	5,973.6	26.4	62.4	7.1
2.....	5,978.0	22.0	58.7	3.4
3.....	6,026.0	26.0	53.1	2.2
4.....	5,956.6	43.4	48.0	7.3
5.....	6,031.6	53.6	49.2	6.1
6.....	6,012.2	12.2	60.4	5.1
Mean.....	36,000.0 6,000.0	183.6 30.6	331.8 55.3	31.2 5.2

The second column in the above table gives the actual ranges. The mean range is obtained by adding all together and dividing by 6, since 6 rounds are considered.

The third column contains the error or difference of each round, irrespective of sign, from the mean range just found. The mean of these differences is then obtained and called the mean error in

range. Evidently, if all the projectiles fall nearly at the same range this mean error will be small.

The fourth column gives the lateral deviation from the direction in which the axis of the bore points before the piece is fired. The mean deviation is at the bottom of this column.

The fifth column gives the differences from this mean, with a mean at the bottom called the mean error in deviation or mean lateral error.

Collecting the results from the table, we have:

	Yards.
Mean range.....	6,000
Mean longitudinal error.....	30.6
Mean deviation right.....	55.3
Mean lateral error.....	5.2

When the position of the center of impact on the horizontal plane is shown, figure 1 shows how the magnitude of the angle of fall determines the position of the center of impact on a vertical target. Thus,



FIGURE 1.

if  $\omega$  be the angle of fall, and if the horizontal target is struck at a distance  $l$  from the vertical one, the latter will be struck at a height which equals  $l \tan \omega$ .

The angle of fall of the 3-inch shrapnel at 6,000 yards is known to be  $23^\circ 40'.9$  and the mean range error of the point of burst of a series of rounds is 30.6 yards for the same range, then the

$$\begin{aligned}\text{Mean vertical error} &= 30.6 \tan 23^\circ 40'.9 \\ &= 13.4 \text{ yards.}\end{aligned}$$

Vertical targets are employed at the shorter ranges, because they may then be of moderate size, and errors due to inequalities of the ground are eliminated, but at long ranges targets can not generally be made large enough to catch all the rounds.

The center of impact on a horizontal target is the intersection of the lines of mean range and mean lateral deviation, and on a vertical target it is the intersection of the lines of mean vertical and mean lateral deviation.

The mean trajectory is that which passes through the center of impact.

In figure 2 the central white line represents the mean trajectory, the dark band is that in which 50 per cent of the trajectories lie; the shaded band is that which contains 75 per cent, while the outer band contains the remainder. The width of these bands is exaggerated in figure 2 for the sake of showing them clearly.

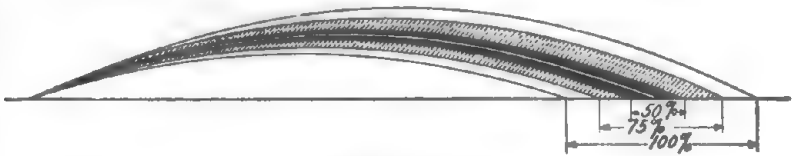


FIGURE 2.

#### PROBABLE ZONES.

It can be shown by the theory of probabilities that if each of the three mean errors is multiplied by the factor 1.69, the widths of zones (of infinite length) which will contain 50 per cent of the hits are obtained.

The mean range error  $\times 1.69$  gives the width of the 50 per cent zone for range; the mean lateral error  $\times 1.69$  gives the width of the 50 per cent zone for deviation; the mean vertical error  $\times 1.69$  gives the width of the 50 per cent zone for height.

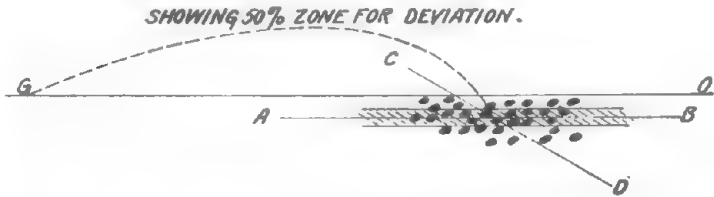


FIGURE 3.

Thus, if GO, figures 3 and 4, represents the direction of the gun, and AB be a straight line parallel to it at a distance equal to the mean lateral deviation, and CD be a straight line at right angles to GO or AB at a distance from the muzzle equal to the mean range; then if the zone in figure 3, called the zone for deviation, and that in figure 4, called the zone for range, each contains 50 per cent of the hits on the surface of the ground, their widths must

be 1.69 times the mean lateral error and 1.69 times the mean range error, respectively. AB and CD are the central lines of these zones.

If now we look at figure 6, where these zones are superposed, we see a rectangle which must contain 50 per cent of 50 per cent, or

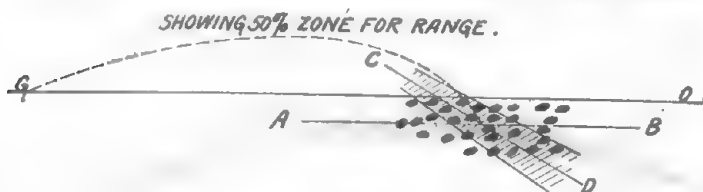


FIGURE 4.

25 per cent of the total number of hits. In a similar manner the 25 per cent rectangle on a vertical target is made up of the intersection of the 50 per cent zones for deviation and height.

The relative accuracy of different guns at different ranges is estimated by the dimensions of this rectangle, which is called the 25 per cent probable rectangle.

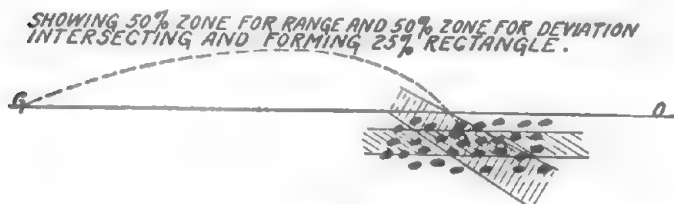


FIGURE 5.

At each range there is a horizontal and a vertical probable rectangle, the width of each is the same, as each has the same zone for deviation, but the relation of the length of one to the height of the other depends on the angle of fall.



TABLE OF PROBABILITY FACTORS.

The following table gives the proportional width of other zones (containing a different percentage of hits) to one of 50 per cent as unity:

Per cent.	Factor.	Per cent.	Factor.	Per cent.	Factor.	Per cent.	Factor.
1	0.02	26	0.49	51	1.02	76	1.74
2	.04	27	.51	52	1.04	77	1.78
3	.06	28	.53	53	1.07	78	1.82
4	.07	29	.55	54	1.09	79	1.86
5	.09	30	.57	55	1.12	80	1.90
6	.11	31	.59	56	1.14	81	1.94
7	.13	32	.61	57	1.17	82	1.98
8	.15	33	.63	58	1.19	83	2.03
9	.17	34	.65	59	1.22	84	2.08
10	.18	35	.67	60	1.25	85	2.13
11	.20	36	.70	61	1.27	86	2.18
12	.22	37	.72	62	1.30	87	2.21
13	.24	38	.74	63	1.33	88	2.30
14	.26	39	.76	64	1.36	89	2.37
15	.28	40	.78	65	1.39	90	2.44
16	.30	41	.80	66	1.42	91	2.52
17	.32	42	.82	67	1.45	92	2.60
18	.34	43	.84	68	1.48	93	2.69
19	.36	44	.86	69	1.51	94	2.78
20	.38	45	.89	70	1.54	95	2.91
21	.40	46	.91	71	1.57	96	3.04
22	.41	47	.93	72	1.60	97	3.22
23	.43	48	.95	73	1.64	98	3.45
24	.45	49	.98	74	1.67	99	3.82
25	.47	50	1.00	75	1.71	100	

Taking the width of a 50 per cent zone as unity, the factors in the above table are the widths of other zones containing different percentages. Thus 80 per cent and 20 per cent zones are, respectively, 1.90 and 0.38 times as wide as the 50 per cent zone.

If the width of the 50 per cent zone is given in yards or feet, the widths of other zones containing different percentages can be obtained by *multiplying* by their corresponding factors. Thus if the width of a 50 per cent zone is 3 yards, the widths of 25 per cent and 72 per cent zones are  $0.47 \times 3 = 1.41$  yards and  $1.60 \times 3 = 4.80$  yards, respectively.

Conversely, if it is required to find what percentage will fall in a zone of given width, the factor must be obtained by *dividing* by the width of the 50 per cent zone.

Thus with the same 50 per cent zone (3 yards wide), as before, what percentages will fall in zones 2 yards and 6 yards wide? The factors are  $2/3 = 0.67$  and  $6/3 = 2.00$ , and they correspond to 35 per cent and 82.4 per cent, respectively.

## GENERAL INFORMATION.

### PAINTING ARTILLERY MATÉRIEL.

The paint issued for this purpose is of olive-drab color, put up in 5-pound cans ready for use, and is applied to both wood and metal parts. If the paint is too thick turpentine should be used as a thinner, but not to greater extent than 2 per cent by volume.

All steel and iron nonbearing surfaces should be painted, including that portion of the underside of the gun between the clips. Wearing and bearing surfaces, teeth of gear wheels, elevating screws, piston rods, cylinders, counter-recoil springs, and interior of cradle should not be painted.

All parts to be painted should be free from dirt or grease. They may be washed in a liquid made by dissolving one-half pound sal soda in 8 quarts of warm water, then rinsed in clean water, and wiped thoroughly dry.

Where the matériel is in fair condition and only marred in spots, the marred places should be primed with olive-drab paint, second coat, and permitted to dry. Then the whole surface should be sandpapered with No. 1½ sandpaper and a coat of paint applied and allowed to dry thoroughly before use.

Where the matériel is in bad condition all parts should be thoroughly sandpapered with No. 2½ sandpaper, be given a coat of paint, and be permitted to dry for at least 24 hours; then sandpapered with No. 00 sandpaper, apply a finishing coat, and permit the parts to dry thoroughly before use.

In general, two coats of paint per year will be sufficient to keep the matériel in good condition. After repeated painting the paint may become so thick as to scale off in places or give an unsightly appearance. It may then be removed for repainting, as follows:

Dissolve 1 pound of concentrated lye, powdered form, in 6 pints of hot water, and slake in enough lime to give the solution the consistency of paint. Use the solution freshly mixed and apply to the parts where paint is to be removed with a brush or with waste tied to the end of a stick. When the solution begins to dry on the surface use a scraper to remove the old paint, and complete the cleaning of the surface with cloth and water. If one application is not sufficient to loosen the paint, apply a second coat. Before painting wash the surface with sal soda water, rinse with clean water, and then wipe thoroughly, as described above.

## OILS FOR ARTILLERY MATÉRIEL.

For the service, cleaning, and preservation of this matériel the Ordnance Department issues hydroline oil, lubricating oil, clock oil, sperm oil, coal oil, neat's-foot oil, and light slushing oil. Each of these oils is suited for the particular purpose for which it is issued, as stated below, and care should be taken that it is not used for other purposes.

The hydroline oil is for use in the recoil cylinders of the carriages *and for no other purpose.*

The lubricating oil will be used exclusively in all oil holes of the matériel and in lubricating such parts as wheels and axles, gun and cradle slides, pintle socket, elevating and traversing mechanisms, exterior of cylinders, brake bearings, hinges, different surfaces of breechblocks, threads of breech recess, etc.

Clock oil should be used on the spindle and all bearings of the battery commander's telescope, bearings of the panoramic sight, range quadrant, and fuze setters, and on the observation telescope, field artillery plotter, and worms of the rear sight.

In all cases clock oil should only be used when the instruments mentioned are disassembled for cleaning. When used it should be applied by dropping from the end of the dropper attached to the end of the cork.

The sperm oil is a lighter lubricant than the lubricating oil and may be used on the gears of sights, fuze setters, range quadrants, parts of revolvers, etc.; lubricating oil may also be used on such parts.

Coal oil is used by the Ordnance Department for cleaning purposes. In the field it may be used for lanterns. Coal oil for general illuminating purposes is furnished by the Quartermaster's Department.

Neat's-foot oil is used for the care and preservation of all leather equipment.

Light slushing oil is prescribed for use in the protection and preservation of all bright or unpainted surfaces of steel or iron on all parts of the equipment when the matériel is to remain unused for an appreciable length of time. Its use as a lubricant for mobile artillery is forbidden.

Before applying the slushing oil to any surface, the part should be thoroughly cleaned, so as to be free from rust, water, coal oil, lubricating oil, etc., as their presence will cause rusting under the slushing oil. The slushing oil should then be applied in a *thin, uniform coat*, since this is ALL that is necessary to give good protection.

Except in very cold weather it can be applied by using a paint brush as when painting; in cold weather it should be applied by stippling; that is, lightly tapping the surface with the end of the sash tool held with bristles perpendicular to the surface to be covered. It can be applied to the bores of guns by the slush brush issued for the purpose. In cold weather it should be warmed before use for coating the bores of guns.

It may be readily removed by the use of burlap or waste dipped in coal oil.

## **REPAIRS FOR FIELD ARTILLERY MATÉRIEL ISSUED TO THE UNITED STATES ARMY, NATIONAL ARMY, AND THE NATIONAL GUARD.**

Instructions relative to making repairs to field batteries and furnishing ordnance stores and supplies for them will be found in the general orders issued by the War Department from time to time.

Instructions in reference to the care, use, and repair of delicate instruments, such as sights, telescopes, and range finders will be found in General Orders, No. 47, War Department, Washington, March 24, 1905, and in O. O. Pamphlet No. 1795.

## **SUGGESTIONS FOR CARE AND MAINTENANCE OF MATÉRIEL.**

Various suggestions in reference to the care of this matériel and hints regarding things to be done or to be avoided are scattered throughout the text of this handbook. Some of the more important are here condensed for more convenient reference. Careful compliance with these suggestions will avoid delay and possible injury to personnel or matériel.

All work upon recoil cylinders, sights, and other optical equipment should be done in the presence of a commissioned officer.

The recoil cylinder should never be clamped in a vise, but when necessary to hold it from turning a spanner applied to front end of cylinder should be used.

Never remove the cylinder end stud nut when the piece is at an elevation.

See that proper kind of oil is used in cylinders and for lubrication. Strain the oil used in filling the cylinders through a fine clean cloth and be sure that the receptacles used in handling the oil are clean.

Take every precaution to keep the interior of the cylinders clean and to prevent the entrance of foreign particles.

In assembling the gland be sure that at least four threads of the gland are engaged with the threads of the cylinder head.

Lash parts with copper wire to prevent unscrewing.

Before firing, inspect to insure that cylinders are properly closed and that the cylinder-end stud nut and the piston-rod nut are in place.

If time permits, oil slides before firing.

Note length of recoil for first few shots to insure that the recoil mechanism is working properly.

If the gun fails to return fully into battery, it is probably due (1) to dirt on slides and guides; (2) to cutting of sliding surfaces on account of dirt and lack of oil; (3) to gland being screwed up too tightly; (4) to dirt or foreign particles in the cylinder, and especially in the counter-recoil buffer recess; (5) to weakness of springs. Ninety per cent of such cases will be found due to (1), (2), or (3).

Lock gun and carriage at drill and in traveling to avoid unnecessary strain upon the pointing mechanism.

Keep hub bolts and hub bands properly tightened.

To tighten the hub bands, screw them as tightly as possible with the wrench and then force them farther by striking the end of the wrench with a hammer.

Replace and properly open all split pins after replacing nuts.

Prevent possible injury to cannoneers by causing them to stand clear of the counter-recoil-spring column in assembling or dismounting.

In moving the gun on or off the cradle, provide ample support for the breech end, so that the gun clips are in prolongation of the cradle guides; if this is not done, the cradle guides may be ruined.

Do not strike any metal part directly with a hammer; interpose a buffer of wood or copper.

Require special care in handling sights.

Do not unnecessarily expose ammunition to the sun or load it into a warm gun before time for firing; if this is done, erratic shooting may result.

Battery commanders should frequently make a detailed inspection of all of the vehicles in the battery to see if any parts of them are broken and any nuts, screws, split pins, etc., missing. If any such defects are found, he should immediately take steps to replace broken or missing parts. This is of the utmost importance, and com-

pliance with these instructions will do much toward prolonging the life of the vehicles.

All wheels and bearings should be frequently oiled.

All nuts secured by split pins should be replaced and properly opened when nuts are screwed home.

All working and bearing surfaces of the carriage require oiling; those not directly accessible for this purpose are provided with oil holes closed by spring covers or handy oilers.

See that fuzes are set at safety for transport.

Use the small primer-inserting press for inserting primers in cartridge cases and the decapping tools provided for removing old primers.

In all requisitions and correspondence the correct name of the part referred to (if known) should be given. If the name of the part is not known, submit a sketch showing the location, shape, matériel, etc., sufficient to establish definitely the identity of the parts in question.

The use of the word "complete" in requisitions to signify a combination of parts sometimes leads to misunderstanding of the exact parts wanted. The tables of nomenclature of parts have been arranged to show the parts included under the terms "one trail, complete; one wheel, complete," etc., and should be carefully studied before requisitions are made out, to insure that all parts wanted are included and duplications avoided. For example, if a piston rod is wanted the order should state whether it is to be with or without the nut. If all details are itemized it will avoid mistakes and unnecessary expense.

*Smokeless powder must not be used for blank charges.*

## SUPPLIES IN GENERAL.

All bits, both curb and snaffle, are made of 27 per cent nickel steel, a practically noncorrosive metal.

The olive-drab saddle blanket is regulation for all arms of the service.

The supply of ammunition to be kept on hand in a 3-inch gun battery will be a sufficient amount to fill all the ammunition chests of the equipment, and in addition a sufficient number of rounds to cover the needs for annual target practice.

Pistol arm racks are issued for use of Field Artillery in such number as may be required to hold the pistols on hand in the battery. Each pistol arm rack holds 80 pistols.

Such articles as may be needed for training the horse the cavesson, longing rein, running rein, etc. may be readily made up by the battery saddler from supplies furnished by the Ordnance Department.

For the training of enlisted men leather heads and wooden stands for supporting them will be needed. The saddler and the carpenter will be able to supply these by means of the tools in the forge limber and battery wagon.

A reloading and cleaning outfit for 75-mm. guns for removing fired primers from and cleaning cartridge cases and for reloading blank ammunition is furnished to each battery.

The following table shows the fire-control instruments and equipment furnished to one battery of 75-mm. guns. The instruments and equipment are carried in two chests on the battery reel which constitutes part of the fire-control equipment.

Complete descriptions of these instruments and instructions for their use are contained in the "Handbook of Fire-Control Equipment."

Number.	Name of instrument.
1.	Aiming circle.
1.	Aiming-circle tripod and case.
10.	Battery commander's ruler, wooden.
2.	Battery commander's telescopes and mounts, model 1915.
5.	Flashlights with hoods.
16.	Flashlights without hoods.
1.	Plotting board, model of 1917.
1.	Protractors, semicircular.
1.	Range finder, 1 meter base complete with cases.
1.	Straight edge, 24-inch, model 1917.
1.	Slide rule, model of 1917.
1.	Steel tape, 30 meters.

## EQUIPMENT.

The following table shows the total equipment of one 75-mm. gun battery model of 1917 (British) on war footing. A place is designated for most of the articles, but the battery commander may use his discretion as to the disposition of many articles for which no particular fitting or receptacle is provided.

*Statement of total equipment of one 75-mm. model of 1917 (British)  
gun battery.*

War footing (4 g ins, 12 calib- sons).	Articles.	Where carried.	Property classifica- tion.	Class. Sec- tion.
4	Guns and gun carriages			
4	Gun limbers			
12	Calissons			
12	Calisson limbers			
1	Forge limber			
1	Battery wagon			
1	Store wagon			
1	Store limber			
1	2-horse reel			
1	Reel (to be mounted on caisson).			
SPARE PARTS FOR GUN.				
1	Breech mechanism, complete	Buttery wagon		
1	Breech-block bushing			
2	Extractor			
1	Fixing screw			
2	Firing trigger			
4	Firing spring			
2	Firing lever			
12	Firing pin			
2	Firing-trigger lever			
2	Hand lever			
2	Hand-lever retaining catch	In leather pouch for spare parts.		
2	Retaining catch			
2	Retaining-catch spring			
2	Retaining-catch pin			
4	Safety-catch spring			
6	Striker			
2	Trigger collar			
2	Tripping piece			
6	Tripping-piece spring			
8	Trigger spring			
SPARE PARTS FOR CARRIAGES.				
100	Assorted split pins	Limber tray		
4	Cap-square pins	do.		
8	Disk springs (brake)	do.		
12	Filling and drain plugs	do.		
8	Firing-gear springs	do.		
8	Oil hole screws, $\frac{1}{8}$ by $\frac{1}{4}$ inch	do.		
8	Packing rings	do.		
8	Packing washers (sets)	do.		
16	Rings-carlock packing	do.		
8	Shield pawl pins	do.		
4	Shield pawl springs	do.		
8	Split keep pins and chain	do.		
4	Stuffing box retaining studs	do.		
4	Traversing lever springs	do.		

IV

3



*Statement of total equipment of one 75-mm. model of 1917 (British)  
gun battery—Continued.*

Property  
classification.

Class. Section.

War  
footing  
(4 guns,  
12 cal-  
sions).

Articles.

Where carried.

SPARE PARTS FOR CARRIAGES—  
continued.

*Tools and accessories for  
carriages.*

1	Breech and sight cover.....	On shield..
1	Can No. 9.....	do.....
1	Drift, small.....	In tool case....
1	Drift, large.....	do.....
1	File, 6 inches, 3 square, dead smooth, double cut.....	do.....
1	File, 8 inches, hand, smooth, double cut.....	do.....
1	File, 10 inches, flat bastard, double cut.....	do.....
1	File handle.....	do.....
1	Hammer.....	do.....
1	Lanyard.....	do.....
1	Muzzle cover.....	do.....
1	Packing tool.....	Limber tray.....
1	Pliers, 8 inches, wire cutting..	In tool case....
1	Screw driver, 3 inches.....	do.....
1	Monkey wrench, 8-inch.....	In tool case....
1	Monkey wrench, 15-inch.....	do.....
4	Spanners, special as detailed	do.....
1	Sponge.....	In trail.....
1	Sponge and rammer.....	do.....
1	Tool case.....	On axle.....
1	Tool for withdrawing split pins.	In tool case....
2	Tools for withdrawing packing.	Limber tray.....

IV. 3

SPARE PARTS FOR GUN LIMBERS.

4	Adjusting collars, wheel.....	Limber tray.....
4	Drag washers.....	do.....
4	Flat split keys.....	do.....
4	Limber hook catch springs.....	do.....
4	Linchpins.....	do.....
4	Neck yokes.....	Fort board, limber..
4	Pole pins.....	Limber tray.....
4	Singletrees.....	Fort board, limber..

*Tools and accessories—Gun  
limber.*

1	Ax.....	On limber.....
1	Grease box.....	do.....
1	Hatchet.....	do.....
1	Lantern.....	do.....
1	Lantern strap.....	do.....
1	Lantern-bracket pad.....	do.....
1	Neck yoke.....	do.....
1	Paulin, 12 by 12 feet.....	do.....
1	Pickax.....	do.....

Statement of total equipment of one 75-mm model of 1917 (British)  
gun battery—Continued.

War footing (4 guns, 12 chil- sons).	Articles.	Where carried	Property classification.	Class.	Section.
	SPARE PARTS FOR GUN LIM- BERS—continued.				
	Tools and accessories—Gun limber—continued.				
1	Picket rope.....	On limber.....			
1	Pole prop.....	do.....			
1	Shovel, short handle.....	do.....			
2	Singl. trass.....	do.....			
3	Tubular oil cans.....	do.....			
3	Watering buckets, canvas.....	do.....			
	SPARE PARTS CAISSON.				
2	Adjusting links, brake.....	In store wagon.....			
2	Adjusting nuts, brake.....	do.....			
4	Apron hngs.....	Spar. parts chest.....			
1	Apron latch, complete.....	do.....			
2	Band guides.....	Store wagon.....			
8	Belleville springs.....	do.....			
2	Brake bands, complete.....	do.....			
10	Brake-band linings.....	do.....			
2	Brake levers with catch.....	do.....			
2	Brake-lever catches.....	do.....			
4	Bolts, brake-lever shaft bear- ing, with nuts.....	Spare parts chest.....			
2	Bolt-pintle bearings with nuts.....	do.....			
1	Bolt tie r. l., with nut.....	do.....			
12	Bolts, carriage, with nuts and lock washers (brake drum)	do.....			
1	Caisson prop, complete.....	Store wagon.....	IV.		3
1	Cat. son, rop chain with hook.....	do.....			
4	Carrying springs.....	do.....			
1	Lunette with nut and washer.....	do.....			
8	Nuts, crown, standard 0.312.....	Spare parts chest.....			
4	Nuts, crown, standard 0.375.....	do.....			
1	Nuts, crown, standard 0.5.....	do.....			
4	Nuts, crown, standard 0.625.....	do.....			
7	Nuts, crown, standard 0.75.....	do.....			
1	Nut, pintle (1.125 crown 0.12 threads).....	Store wagon.....			
1	Pintle spring.....	do.....			
1	Pintle-spring plunger.....	do.....			
15	Pins, $\frac{1}{8}$ by 0.812, split.....	Pouches for spare parts.....			
2	Pins, $\frac{1}{8}$ by 0.75.....	do.....			
6	Pins, $\frac{1}{8}$ by 1.25.....	do.....			
48	Pins, $\frac{1}{8}$ by 1.....	do.....			
2	Pins, $\frac{1}{8}$ by 1.5.....	do.....			
6	Pins, $\frac{1}{8}$ by 1.75.....	do.....			
8	Pins, $\frac{1}{8}$ by 2.....	do.....			
4	Pins, $\frac{1}{8}$ by 2.25.....	do.....			
4	Screws, axle hatchet.....	Store wagon.....			
8	Side-rail liners, right.....	do.....			
8	Side-rail liners, left.....	do.....			
3	Wheels, complete.....	Where convenient.....			

*Statement of total equipment of one 75-mm. model of 1917 (British)  
gun battery—Continued.*

War footing (4 guns, 12 cui- sons).	Articles	Where carried.	Property classifica- tion.	Class.	Sec- tion.
	SPARE PARTS—CAISSON—contd.				
	<i>Tools and accessories—Caissons.</i>				
12	Axes.....	Outside of chest, caisson.....			
12	Paulins, 12 by 12 feet.....	On chest seat, caisson.....			
12	Pick matt cks.....	Outside of chest, caisson.....			
12	Shovel, 1 ng handled.....	Below front frame, caisson.....			
12	Spanners.....	Outside of chest, caisson.....			
12	Wrenches, $\frac{3}{4}$ and $\frac{1}{2}$ .....	do.....			
	SPARE PARTS—CAISSON LIMBER				
2	Bolts, axle bracket, with nut.....	In spare-parts chest.....			
2	Bolts, pintle-bearing guide, with nut.....	do.....			
1	do.....	do.....			
1	Bolts, pile clamp with nut.....	do.....			
1	Bolts, guide, with nut.....	do.....			
3	Bolts, doubletree, with nut.....	do.....			
1	Bolts, pintle bearing, with nut.....	do.....			
1	Bolts, trunnion.....	do.....			
2	Chains, No. 11, complete.....	Store wagon.....			
2	Double hooks (1 right, 1 left) with screw and nut.....	Spare-parts chest.....			
2	Doubletrees, complete.....	do.....			
2	Hub caps, complete.....	Store wagon.....			
3	Hub latches.....	In store wagon.....			
3	Hub-latch plungers.....	do.....			
3	Hub-latch rivets.....	do.....			
3	Hub-latch springs.....	do.....			
3	Hub-latch liners.....	do.....			
3	Lock washers.....	Spare parts chest.....			
4	Nuts, crown, $\frac{3}{4}$ -inch.....	In spare-parts case.....			
4	Nuts, crown, $\frac{1}{2}$ -inch.....	do.....			
2	Nuts, crown, $\frac{3}{4}$ -inch.....	do.....			
1	Nuts, crown, 1-inch.....	do.....			
1	Nuts, pintle.....	do.....			
2	Nuts, spring rod.....	do.....			
3	Oil valves, complete.....	do.....			
2	Padlocks, complete.....	Store wagon.....			
2	Pintles with bearing, complete.....	Carried loose.....			
2	Pintles.....	do.....			
2	Pintle bearings.....	Spare-parts chest.....			
1	Pintle bearing spring.....	do.....			
1	Pintle latch.....	Carried loose.....			
2	Pintle-latch springs.....	Spare parts chest.....			
2	Pintle-latch pins.....	do.....			
2	Poles, complete.....	On caisson.....			
2	Pole-supporting springs.....	Carried loose.....			
	Pins, assorted.....	Pouch for spare parts.....			
1	Pin-spring rod with split pin.....	do.....			
6	Pin-tie rod (2 of each).....	do.....			
1	Spring rod.....	Store wagon.....			
1	Strap fastener No. 1.....	Spare parts chest.....			
3	Wheels, complete.....	Where convenient.....			
3	Wheel fastenings, complete.....	Store wagon.....			
1	Wing nut.....	Pouch for spare parts.....			

IV

3

Statement of total equipment of one 75-mm. model of 1917 (British)  
gun battery—Continued.

War footing (4 guns, 12 cais- sons).	Articles.	Where carried.	Property classification.	Class.	Sec- tion.
	SPARE PARTS—CAISSON LIM- BER—continued.				
	Tools and accessories—Caisson limber.				
12	Axes.....	Outside of chest, on limber..	IV	3	
36	Buckets, watering, canvas.....	On limber.....			
12	Hatchets.....	Outside of chest, on limber..			
12	Lanterns.....	do.....			
12	Lantern-bracket pads.....	do.....			
12	Neck yokes.....	On pole.....			
2	Neck yokes (spares).....	Where convenient.....			
36	Oil cans, tubular.....	In ammunition chest on limber.....			
2	Oil cans, tubular (spares).....	do.....			
4	Oil-can nozzles (spares).....	Store wagon.....			
12	Paulin, 12 by 12 feet.....	On limber seat.....			
12	Pickaxes.....	Outside of chest on limber..			
12	Picket ropes.....	do.....			
12	Pole props.....	Underframe, on limber.....			
2	Pole props (spares).....	Store wagon.....			
12	Shovels.....	Under chest, on limber.....			
24	Singletrees.....	On doubletrees.....			
4	Singletrees (spares).....	Where convenient.....			
	TOOLS AND ACCESSORIES FOR FORGE LIMBER.				
1	Ax.....	On limber under chest.....	IV	9	
3	Buckets, watering, canvas.....	On limber in bucket holder..			
2	Dust guards.....	On wheels.....			
1	Hatchet.....	In bracket on left of chest..			
1	Hub-liner driving tool.....	In forge limber.....			
1	Lantern.....	On limber, in bracket on front of chest.....			
1	Lantern-bracket pad.....	In lantern bracket.....			
1	Neck yoke.....	On pole.....			
2	Oil cans, tubular.....	On limber, in supports under chest.....			
1	Paulin, 12 by 12 feet.....	On limber chest as cushion..			
1	Pickax.....	On limber foot rest.....			
1.1	Picket rope.....	On limber in front of chest..			
1	Pole prop.....	On limber, in fastenings under frame.....			
1	Shovel, short-handled.....	On limber, under chest.....			
2	Singletrees.....	Attached to doubletrees.....			
	Straps:				
1	Ax.....	In strap fasteners.....	IV	3	
3	Grip.....	do.....			
1	Hatchet.....	do.....			
1	Lantern.....	do.....			
4	Lantern-blanket front.....	do.....			
4	Lantern-blanket rear.....	do.....			
3	Paulin.....	do.....			
1	Pick handle.....	do.....			
1	Pick head.....	do.....			
4	Picket rope, upper.....	do.....			
4	Picket rope, lower.....	do.....			
1	Pole prop.....	do.....			
1	Shovel handle.....	do.....			
1	Sledge.....	In fastener.....			

*Statement of total equipment of one 75-mm. model of 1917 (British)  
gun battery—Continued.*

War footing (4 guns, 12 cal- sions).	Articles.	Where carried.	Property classification.	Class.	Section.		
	TOOLS AND ACCESSORIES FOR STORE LIMBER.						
1	Ax.....	On limber under chest.....	IV	9			
3	Buckets, watering, canvas.....	In bucket holder.....					
1	Cyclometer for 56-inch wheel....	On axle of limber.....	IV	3			
2	Dust guards.....	On wheels.....					
1	Hatchet.....	On limber in bracket.....	IV	9			
1	Lantern.....	On limber in bracket on chest front.....					
1	Lantern-bracket pad.....	In brackets.....	IV	3			
1	Neck yoke.....	On pole.....					
2	Oil cans, tubular.....	On limber, in supports.....	IV	9			
1	Paulin, 12 by 12 feet.....	On limber chest as cushion.....					
1	Pickax.....	On limber foot rest.....	IV	3			
1	Picket rope.....	On limber, in front of chest.....					
1	Pole prop.....	In fastening under frame.....	IV	9			
1	Shovel, short-handled.....	On limber under chest.....					
2	Singletrees.....	Attached to doubletrees.....	IV	3			
	Straps:						
1	Ax.....	In strap fasteners.....	IV	3			
3	Grip.....	do.....					
1	Hatchet.....	do.....					
1	Lantern.....	do.....					
4	Limber blanket, front.....	do.....					
4	Limber blanket, rear.....	do.....					
3	Paulin.....	do.....					
1	Pick handle.....	do.....					
1	Pick head.....	do.....					
4	Picket rope, upper.....	do.....					
4	Picket rope, lower.....	do.....					
1	Pole prop.....	do.....					
1	Shovel, handle.....	do.....					
	SPARE PARTS FOR BATTERY WAGON.						
1	Chain, No. 10.....		IV	9			
1	Chain, No. 13.....						
1	Chain, No. 12.....						
2	Lock washers.....						
3	Padlocks, No. 850.....		IV	3			
	TOOLS AND ACCESSORIES FOR BATTERY WAGON.						
1	Carpenters' chest, with tools, set.....	In battery wagon.....			IV	9	
1	Chest for cleaning material and small stores.....	do.....					
1	Chest for spare breech mechan- anism.....	do.....			IV	3	
1	Chest for spare sights, con- taining—						
	1 bore sight, breech.....	In battery wagon.....			IV	3	
1	1 bore sight, muzzle.....	do.....					
1	Double-tackle block.....	do.....			IV	3	
2	Dust guards.....	On wheels.....					

Statement of total equipment of one 75-mm. model of 1917 (British)  
gun battery—Continued.

War footing (4 guns, 12 cal- sions).	Articles.	Where carried.	Property classi- fication.	
			Class.	Sec- tion.
	<b>TOOLS AND ACCESSORIES FOR BATTERY WAGON—contd.</b>			
1	Forge coal bag.	On battery wagon.	IV	3
1	Filling funnel, cylinder.	In battery wagon.	IV	9
1	Grindstone with frame, com- plete.	do.	IV	9
1	Lever sack.	do.	IV	9
1	Marking outfit for stamping leather.	In cleaning-material and small-stores chest.	X	5
1	Marking outfit for stamping metal.	do.	X	5
3	Oil cans, 5-gallon.	In oil-can supports.	IV	9
1	Ordnance Department insignia stencil.	In cleaning-material and small-stores chest.	X	5
1	Packing chest for supplies.	In battery wagon.	IV	3
1	Packing chest for spare parts.	do.	IV	3
1	Paulin.	On battery wagon.	IV	9
1	Rope, 70 feet long.	In battery wagon.	X	9
1	Saddler's chest, with tools, set.	do.	X	5
1	Seal stamp.	In cleaning-material and small-stores chest.	X	5
1	Single-tackle block.	In battery wagon.	IV	9
2	Spare-wheel hub covers.	On spare wheels.	IV	3
2	Spring centering tools.	In battery wagon.	IV	9
2	Spring compressors, No. 1.	do.	X	9
1	Stencil outfit.	In cleaning-material and small stores chest.	X	5
	<b>Straps:</b>			
2	Grindstone.	In strap fasteners.	IV	3
2	Grip.			
1	Jack lever.			
4	Paulin.	do.	IV	9
1	Spare pole.	do.	IV	9
1	Testing level and chest.	In battery wagon.	IV	9
1	Vise.	Attached to lunette frame.	X	9
2	Water buckets, galvanized steel.	In battery wagon.	IV	9
1	Wrench, grindstone and recoil-spring assembling.	do.	IV	3
	<b>TOOLS AND ACCESSORIES FOR STORE WAGON.</b>			
20	Bolos.	In store wagon.	VII	5
20	Bolo sabbers.	do.		
1	Chest for miscellaneous spare parts.	do.		
1	Crowbar.	On store wagon, under body.	IV	3
2	Dust guards.	On wheels.		
1	Filling funnel, cylinder.	In store wagon.		
3	Oil cans, 5-gallon.	On store wagon in oil-can supports.		

*Statement of total equipment of one 75-mm. model of 1917 (British)  
gun battery—Continued.*

War footing (4 guns, 12 caissons).	Articles.	Where carried.	Property classification.	
			Class.	Section.
TOOLS AND ACCESSORIES FOR STORE WAGON—contd.				
1	Paulin, 12 by 12 feet.....	On store wagon in off-can supports.	IV	9
1	Slush brush.....	do.....		
	Straps:			
1	Crowbar.....	In strap fasteners.....	IV	3
2	Grip.....			
2	Paulin.....			
	Spare pole.....	In store wagon.....		
2	Spare-wheel hub covers.....			
<i>Spare parts of accessories for store wagon.</i>				
4	Ax helves.....	do.....	IV	9
2	Handles, shovel, long.....	do.....		
3	Handles, shovel, short.....	do.....		
4	Handles, hatchet.....	do.....		
4	Handles, pickax.....	do.....		
MISCELLANEOUS PARTS.				
64	Fuze boxes for Mark III fuze.....			
64	Fuze boxes for Mark V fuze.....			
SPARE PARTS FOR HARNESS.				
4	Breast collars, complete.....	In battery wagon.....		
3	Bridles and bits, near.....	do.....		
3	Bridles and bits, off.....	do.....		
6	Barrel roller buckles, 1 2 1/2 inch.....	In store wagon.....		
2	Backstrap hooks.....	do.....		
4	Choke straps.....	do.....		
12	Cincha, lead (breast).....	do.....		
6	Cincha, wheel (breast).....	do.....		
2	Collar pads, complete.....	do.....		
20	Curb chains with hook, model 1912.....	do.....	X	9
2	Double-eye hooks.....	do.....		
8	Feed bags.....	do.....		
8	Grain bags.....	do.....		
6	Halter head stalls.....	do.....		
20	Halter tie ropes, model of 1912.....	do.....		
6	Martingales with cincha straps.....	do.....		
2	Neck yokes with neck straps.....	do.....		
2	Pad strap buckle pieces.....	do.....		
6	Side straps for breeching.....	do.....		
4	Springs, Mogul.....	do.....		
12	Stirrup straps.....	do.....		
2	Snap hooks, Covert 2-inch.....	do.....		
8	Traces, lead.....	do.....		
4	Traces, wheel.....	do.....		
4	Whips, artillery.....	do.....		

Statement of total equipment of one 75-mm. model of 1917 (British)  
gun battery—Continued.

War footing (4 guns, 12 cal- sions).	Articles.	Where carried	Property classification.	
			Class.	Section.
	SADDLER'S TOOLS.			
12	Awl blades, harness, assorted...	In saddler's chest in battery wagon.		
1	Awl, pegging	do.		
1	Awl, seat, handled	do.		
1	Carriage, pricking, 3 wheels	do.		
1	Compass, 6 inches	do.		
1	Creamer, double, lignum vitae	do.		
1	Claw tool	do.		
1	Edge tool, No. 1	do.		
1	Edge tool, No. 2	do.		
2	Extra blades, with followers, for draw gage.	do.		
1	Gage, draw, brass	do.		
2	Halls, patent, awl, rosewood	do.		
1	Hammer, No. 3, riveting	do.		
1	Handle, peg, awl, with wrench	do.		
1	Knife, round	do.		
1	Knife, splitting, 6-inch	do.		
1	Needle case, leather	do.		
1	Needle, glove's, No. 3, papers	do.		
2	Needles, harness, No. 4, papers	do.		
2	Needles, harness, No. 5, papers	do.		
2	Needles, harness, No. 6, papers	do.		
12	Needles, sacking, assorted	do.		
1	Nipper, cupping, 10 inch	do.		
1	Oilstone, unmounted	do.		
1	Pliers, 6 inch	do.		
4	Punches, hand, round, assorted	do.		
1	Punch, revolving	do.		
1	Rivet sets	do.		
1	Rule, boxwood, 2-foot, 4-fold	do.		
1	Screw drivers, 3-inch blade	do.		
1	Sewing palm, leather	do.		
1	Shears, 10-inch bent trimmers	do.		
1	Shoe knife, square point	do.		
1	Shoe knife, broad point	do.		
1	Slicker, steel	do.		
2	Thimbles	do.		
	CARPENTER'S TOOLS.			
1	Bench ax	In carpenter's chest in battery wagon.		
2	Bags, canvas, for small stores	do.		
1	Bevel, 8-inch	do.		
6	Bits, auger	do.		
1	Bit, wood countersink	do.		
1	Bit, expansive, 2 cutters	do.		
3	Bits, screw driver	do.		
1	Brace, ratchet, 10-inch sweep	do.		
3	Chisels, socket, framing	do.		
1	Divider, wing, 10-inch	do.		
4	Drills, twist	do.		



*Statement of total equipment of one 75-mm. model of 1917 (British)  
gun battery—Continued.*

War footing (4 guns, 12 cais- sons).	Articles.	Where carried.	Property classifica- tion.	
			Class.	Sec- tion.
	CARPENTERS' TOOLS—contd.			
1	File, 10-inch, flat, bastard.....	In carpenter's chest in bat- tery wagon.		
6	Files, saw, 4 and 6 inch (3 of each).....	do		
1	Gage, marking, brass, thumb- screw shoe and face.....	do		
2	Gauges, socket firmer.....	do		
1	Hammer, claw, adz eye.....	do		
1	Handle, tool, containing 10 tools.....	do		
2	Handles, file, aluminum alloy.....	do		
1	Knife, drawing, 9-inch blade.....	do		
1	Mallet, 2½ by 5 inches, maple, hickory-handled.....	do		
1	Nail set.....	do		
1	Oiler.....	do		
1	Oilstone, unmounted.....	do		
1	Pincer, small, 8-inch.....	do		
1	Plane, jack, wood.....	do		
1	Plane, smoothing, wood.....	do		
1	Plate, auger handle.....	do		
1	Rasp, wood, 10-inch.....	do		
1	Reamer, half-round, for wood or soft metal.....	do		
1	Rule, boxwood, 2-foot, 4-fold.....	do		
1	Saw, crosscut, 24-inch.....	do		
1	Saw, rip, 24-inch.....	do		
1	Saw set.....	do		
1	Screw driver, 5-inch blade, 10 inches.....	do		
1	Sporeshave, adjustable.....	do		
1	Square, steel, 12-inch body, 8- inch tongue.....	do		
1	Tape line, linen.....	do		
1	Vise, table, 24-inch.....	do		
1	Wrench, screw, 12-inch.....	do		
	BLACKSMITH'S TOOLS.			
1	Anvil, 100-pound.....	In forge limber chest		
3	Aprons, blacksmith's.....	do		
2	Bags, canvas, for nails.....	do		
1	Box, shoeing, leather.....	do		
1	Chisel, cold, 8-inch.....	do		
1	Chisel, handled, for cold iron, 2 pounds.....	do		
1	Chisel, handled, for hot iron, 1.5 pounds.....	do		
1	Clinching iron.....	do		
6	Clinching drills, flat.....	do		
1	File, flat, 12-inch, bastard.....	do		
1	Fire rake.....	do		
1	Fire shovel.....	do		

*Statement of total equipment of one 75-mm. model of 1917 (British)  
gun battery—Continued.*

War footing (4 guns, 12 cul- sons).	Articles.	Where carried.	Property classification.	Class.	Sec- tion.
	BLACKSMITH'S TOOLS—contd.				
1	Flatter, handled, 1.5-inch, square face.....	In forge limber chest.....			
1	Fore punch and crease.....	do.....			
1	Forge, Empire, portable.....	do.....			
1	Hammer, hand, 2-pound.....	do.....			
1	Hammer, riveting, 1 pound 2 ounces.....	do.....			
1	Hammer, shoeing, 10-ounce.....	do.....			
1	Handle, file aluminum.....	do.....			
1	Hardie, 0.75-square shank, 1.25 in.....	do.....			
1	Cutting nippers, 14 inch.....	do.....			
1	Oil.....	do.....			
1	Pritchel, 0.75 flats, 9-inch.....	do.....			
1	Punch, round, 0.375-inch.....	do.....			
1	Punch, round, 0.312 $\frac{1}{8}$ -inch.....	do.....			
1	Punch, nail.....	do.....			
1	Punch, square.....	do.....		X	
1	Ratchet drill.....	do.....			
5	Rivet sets, 5 sizes.....	do.....			
1	Rule, boxwood, 2-foot, 4-fold.....	do.....			
1	Screw plates, taps and dies, with tap wrench, including chest.....	do.....			
2	Shoeing knives.....	do.....			
1	Shoeing pincers.....	do.....			
1	Shoeing rasp, 16-inch.....	do.....			
1	Sledge, 11-pound.....	do.....			
1	Square.....	do.....			
1	Toe knife.....	do.....			
1	Tongs, horseshoer's.....	do.....			
1	Tongs, for 0.25 iron.....	do.....			
1	Tongs, for 0.5 iron.....	do.....			
1	Whetstone, farriers', 10-inch.....	do.....			
1	Wrench, screw, 12-inch.....	do.....			

WAR DEPARTMENT.

OFFICE OF THE CHIEF OF ORDNANCE.

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